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OFFICE OF SECRETARY WESTERN GAS ENGINEERS AND SUPERINTENDENTS' ASSOCIATION,
LOUISIANA, MO., March 25, 1879.

The Annual Meeting of the above Association will be held at the Tremont House, in Chicago, on Wednesday, May 14th, 1879, at 10 o'clock, A. M.

LEE A. Hall, Secretary.

Electric Light in London.

As we were informed, the ghastly, flickering exhibition of the electric light on the Holborn Viaduct is to come to an end. As a matter of fact it has come to an end; for the three months' contract expired on Sunday March 9th, and the lights were extinguished the day previous. Having to cross the Viaduct frequently, we have given careful attention to these lights, and while frankly admitting that, on some evenings, and for the short periods over which our observations have extended, the light burnt remarkably well, yet it must be admitted that, on the whole, the exhibition has been a dismal failure. The Viaduct is exceptionally well adapted for the experiment; but the light has utterly failed to satisfy the simplest requirements of a public illuminating agent. We want strength, diffusibility, and constancy, and the electric light does not give one of these. With regard to the experiment of the Thames Embankment, from the few observations we have made, the results seem to be no better than those obtained on the Viaduct. The light, which would have paled before the display Messrs. Edmundson will soon make there, ends with this week. *Sic transit.*—London *Journal of Gas-Lighting.*

THE PRICE OF GAS IN HARTFORD, CONN.

On March first the price of gas in the above-named city was reduced to $2 per thousand. The dullness of the times, the much lower price for the much inferior light given by kerosene, and the general demand for reduction in the price of everything seemed to necessitate, on the part of the management, some action; and the determination was arrived at unanimously by the direction, to put the price at two dollars, and rely upon the increase of business for the small profit to be realized by selling gas at that price in that locality. The question was, practically, whether to accept smaller dividends or go without.

It is not to be expected that a company, having to sell gas at this price, is going to pay 10 per cent. dividends, when the capital stock is equivalent to $10 for every thousand feet of gas sold during the year—for that requires just one dollar on each thousand feet sold. But where the capital stock of any company is an honest one, that is, represents anything like a fair valuation of the plant, there are probably very few works in the country to-day but could, just as well as not, double the amount of gas sold without increasing the works. Here is where the capital account comes into the calculation. A majority of the companies are overloaded with capital, and there are two ways to overcome this trouble; one is to reduce the capital, and the other is to increase the amount of gas sold. If this is true of large capitals, it is still more true of the smaller ones. If those having fair capitals would secure remunerative dividends in the future, the sure way to do it is to place the price of gas at such a figure that no one will think of using anything in preference to gas for illuminating purposes. This will certainly increase the amount sold, and will pay in the long run. Those overloaded with capital should either reduce capital or reduce dividends. Those having honest capitals have simply to reduce the price, and, perhaps, the dividends for a short time, and the increase of business will certainly restore the dividends to a fair rate. The one month's experience in this experiment at Hartford seems to indicate very clearly that these ideas are correct. Many using oil have already returned to gas, and more will do so.

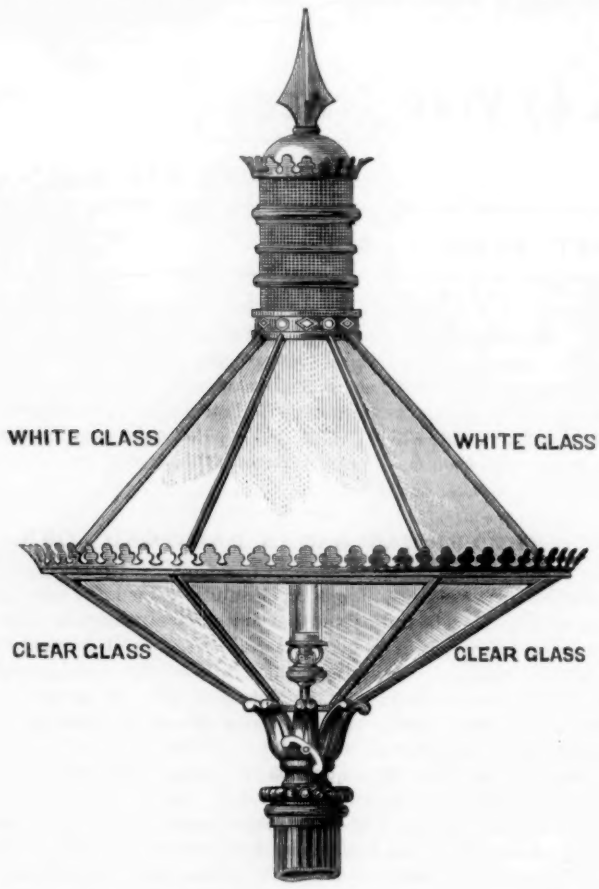
THE PROPER COMBUSTION OF GAS.

The subject of getting the most light possible from a given amount of gas is one of vital importance to all gas consumers; and the best way to secure this is by having the consumer properly instructed in this matter. The short and concise paper read by Mr. James Somerville, at Cincinnati, is directly to the point, so far as the matter of globes and burners is concerned; and the small pamphlet, by Mr. Taber, upon the domestic applications of gas, covers the essential points. These we are ready to furnish to gas companies for distribution at about the cost of printing, and we believe that many companies have been benefitted by the judicious use of these tracts. Such is the testimony we have received in several instances. The dissemination of correct information is the true way to overcome unfounded prejudice.

Improved Gas-Lighting.

We publish herewith an illustration of Mr. Sugg's improved gas burner and lamp, as employed in Waterloo Place, and we reproduce from a recent issue of the London *Times* the following description of the system:

"The ordinary lighting of this piece of roadway, which is about 500 yards in length, and of considerable width at the lower end, is effected by means of 42 lamps, burning 2½ cubic feet per hour, and the light from each



was equal to nine candles. Thirty-six of these lamps are on the footways, four on the street refuges, one between the Athenæum and the United Service clubhouses, and one opposite the County Fire Office. There were, therefore, 105 cubic feet of gas used per hour in these lamps, which, being cannel gas, costs 4s. 4d. per 1000 cubic feet, and amounts to 5½d. per hour. There are also several lamps attached to the Guards' Memorial, but owing to their special construction they had to be excluded from the experiment. The 36 footway lamps have had the old lanterns and burners removed, and they have been replaced by new lanterns, specially designed by Mr. Sugg, and his London argand burners, having two concentric columns of flame. In each of these the consumption of gas is 19 cubic feet per hour, and the light produced is equal to 80 candles. In four instances the ancient lamp-posts have been superseded by others of modern construction, designed by Mr. Sugg, and which have several structural features below as well as above to recommend them. The four lamps on the refuges have the improved lanterns, and are now fitted with London burners, having three concentric columns of flame, each burner consuming 23 cubic feet of gas per hour, and affording the light of 100 candles. The two improved lanterns on the standards between the Athenæum and the United Service Clubs have the same kinds of burners, but with four concentric flames, consuming 45 feet of gas per hour, and giving a light equal to 200 candles.

Photometrical Value of Electric Light.—It is rather to be regretted that photometrical experiments are not to be made to determine the relative values of the two lights. Not that mere candle power, estimated in a dark room, would give us an accurate idea of the value of the electric light. It has been shown, for example, that the light, at all events when enclosed in an opaline globe, will not penetrate a London fog so far as a single gas-burner of much less candle power. The same thing has been observed in lighthouses. It has been proved that the light given by Mr. Wigham's gas burners is seen at a greater distance in a sea fog than the electric light without the interposition of any opaline shade.—London *Journal of Gas-Lighting.*

[From London "Journal of Gas Lighting."]

Midland Association of Gas Managers.

Address of Charles Hunt, Prest.

[Continued from page 126.]

Thus the loss in one direction is so far balanced by a saving in the other, that, on the most favorable showing, there remains a difference of only 9-100th of a penny per 1,000 in favor of the four-hour system as practiced in Paris; while there can be little doubt that, if local circumstances—such, for instance, as the raising of capital by local authorities at a lower rate of interest than that which forms the basis of the above calculation—were taken into account, this slight difference would, in many instances, entirely disappear, or be reversed. It is, in fact, clear enough, upon close examination, that the two sets of workers have been and are compassing almost the same end by somewhat different means.

But, gentlemen, gratifying as it may be to us to know that we are able to hold our own in comparison with a system that produces such excellent results, our object would be but imperfectly accomplished without a reference to results obtained elsewhere, which are calculated to dim the lustre of those we have just been contemplating. Had our American friends, in the discussion to which I have alluded, given prominence to the details of their own successful working, they would assuredly have established more solid ground for their criticism than is afforded by the comparison which they instituted. 11,000 feet per ton, 7000 to 8000 feet per mouthpiece, and a lasting power of the retort equal to a production of 5 million cubic feet, are results which may well excite our admiration, and almost fill us with envy. It is needless to inquire whether they are possible without an expenditure of fuel which we should call extravagant, when it is recollected that in Germany the like results are said to be obtained with a positive economy of fuel. As to this latter, the Germans, if our information is to be relied on, appear to be unique at the present time. They alone have achieved an advance in this direction which it would be well for us to study, and, as far as possible, to imitate. At Cologne, last summer, I was conducted with much courtesy through a gas works in which the whole of the retorts were heated by means of furnaces similar in construction to those with which Mr. G. E. Stevenson made us acquainted at our last meeting. The fuel is thus supplied to the retort beds in a gaseous form; the air necessary to combustion being, previous to admixture, raised to a high temperature by contact with the brickwork of the exhaust flue, so that in this way heat, which would otherwise, as with us, be wasted, is utilized almost in the same manner as by a Siemens regenerative furnace. The retorts are set in beds of sevens and eights; are oval in shape, about 20 inches by 15 inches, by 9 feet long; last 18 months, and are found equal to carbonizing about 1,760 lbs. of coal (five hour charges) every 24 hours, producing 11,000 cubic feet per ton of 16½-candle gas, and this with a consumption of fuel not exceeding 22 per cent. of the coke produced. Such are the figures as they were given me, and they are in many respects confirmed by reports from other works where analogous systems of firing have been adopted. In addition may be mentioned the arrangement by which the furnaces are fed—namely, through a hole in the floor of the retort-house—as one which evidently admits of considerable saving being effected upon this portion of the work. Similar furnaces, being likewise a modification of Siemens regenerative furnace, which latter was formerly in use at the Windsor Street works, are largely employed in Paris, and are worked at a considerable economy of fuel; but the German arrangement appears to carry off the palm for simplicity—a condition essential to success in all our operations.

The Exhibition of Gas Heating Apparatus which was opened at Birmingham last June, was probably the most important of the kind ever attempted. Following close upon the one held during the preceding year at South Shields, it pointed yet more clearly, and with increased emphasis, to that wide field for the employment of coal gas, which, hitherto neglected, needs only to be worked with energy and intelligence to become a chief source of revenue to the manufacturer. It may with truth be said that whereas, in the provision of light we have many competitors, and are threatened with more; on the other hand, as purveyors of gaseous fuel, we are beyond the reach of rivalry, and the chief obstacles in the way of success are of our own creating. So accustomed have we become to a consumption increasing year by year without effort on our part, except what is necessary to keep pace with it, that this increase has almost come to be regarded as a sort of natural consequence, requiring neither encouragement nor stimulus from ourselves; and thus it has come to pass that the consumers have been left very much to themselves, to find out, as best they might, the most convenient methods of applying the commodity which we have contented ourselves with leaving at their doors, scarcely ever deigning to inquire, after the manner of an indefatigable tradesman, "What more can we do for you?" Need it, then, be a matter for surprise if, neglected by their natural advisers, they fall an easy prey to ignorance and incapacity, and, tormented by unskilful devices, give vent to their dissatisfaction in the shape of loud

complaints of the quality of the gas, wholly unmerited, but which none the less serve to cover the manufacturer with odium, and materially to check the development of his business?

It is, however, satisfactory to observe, whatever cause may have operated to bring about the change, that a different feeling is now abroad, and that in many directions efforts are being made to bring about a better understanding with the consumer, by the dissemination of information as to the various purposes for which gas may be usefully employed, and also as to the correct principles that govern its economical consumption. Full of significance, likewise, is the fact that the attention of Parliament is about to be directed to applications for increased powers from some of the most influential of the metropolitan companies—applications, the necessity for which may not be altogether clear to the non-legal mind, accustomed to regard as sufficient the provisions of the Gas Works Clauses Act, 1847, but of which the object is perfectly intelligible, and; perhaps it may be permitted to add, altogether praiseworthy. That all companies and corporations should be possessed of full powers for the supply to consumers of all kinds of gas fitting and heating apparatus, is a question of policy and convenience respecting which there can hardly be two opinions; while the further step of entrusting them with the exercise of a certain amount of control over all internal fittings, burners included, might be ventured upon with the certainty of its proving advantageous to all parties concerned. It is not, however, difficult to foresee that in the enforcement of a code of rules as to the size and equality of fittings, even though framed, as it unquestionably would be, in the best interests of the consumer, a certain appearance of arbitrariness and interference with private interests could scarcely be avoided; and this, although productive of no real grievance, would not add to the popularity of the companies at the present time. But much may be done, in the immediate future, toward bringing over the public to their side, by a judicious exercise of the new powers that will certainly be granted them. In the meantime we may wish them all success in their new enterprise, deriving encouragement to indulge in the most hopeful auguries for the future of our industry, from the prospect thus held out to us of witnessing in "fresh fields and pastures new" a reflex of those achievements by which has been built up and consolidated the most colossal gas enterprise the world has yet seen.

It would be unnecessary to dwell for more than a brief moment, in passing, upon the manifest advantage of the fuller employment of our mains during the daytime, were it not that speculation has of late been rife as to the probable effect of an extended use of gas for heating purposes, upon incidents of its manufacture. We have been treated to ideal pictures of gas works "running" with unbroken regularity all the year round; of full gangs of stokers in constant employment; while the subtle aid of figures has been invoked to prove to the consumer how much he has to hope for from the utilization of plant which his own perverseness has hitherto condemned to comparative idleness during the greater portion of every 24 hours. I am to the last degree reluctant to disturb the harmony that prevails with regard to these pleasing anticipations; nor is it possible to suppose that I am wishful in any way to undervalue the importance of the movement now so happily set on foot; but a word, by way of caution, is evidently necessary, lest we may be tempted to indulge in expectations which it is hopeless to expect can ever be realized. What is there, either in past experience or present necessities, to warrant the belief that the employment of gas for heating purposes can by any possibility be confined to warm summer weather? Granting all that can be urged as to its special convenience for cooking at a time when open fires are felt to be a nuisance, are we content that this should be the limit to its sphere of usefulness? Are we prepared to go to the consumer—it may be in the month of November, when he begins, perhaps, to think of his little dinners—and say to him, "We did not reckon upon having to supply your cooking stove during our busy season; would you oblige us by disconnecting it until the spring?" That certainly would not be the way to encourage consumption, for the chances are that he would turn round and say, "If I cannot have the use of gas when I want it most, I am better without it altogether." And yet this would be but a logical outcome of the adoption of estimates founded upon a purely theoretical assumption. Before it can be said that any portion of our consumption yields us an exceptional rate of profit, we must be certain that such consumption does not or cannot, wholly or in part, follow us throughout the year. What is found to be the case in practice? In Birmingham, at any rate, we have been far from realizing the predictions of Mr. Henry Woodall. It is true that cooking stoves induce a consumption in the summer months, which is found to be very welcome; but our experience is that people who begin the good habit of cooking by gas in the summer time, are not, as a rule, inclined to leave it off as the winter approaches; and small blame to them for thus taking full advantage of its cleanliness and economy. At the same time, it is found that the consumption thus induced is a small matter as compared with that exclusively winter demand created by the constantly growing favor with which the public regard the use of gas for warming their houses, shops, and offices. Gas fires consume far more gas than cooking stoves, and ought to be encouraged to the greatest possible extent. We do encourage them, and have done so for years. It must be a correct principle to encourage the use of gas for every purpose for which it is applicable; but by so doing we find ourselves unable to take credit for any differential rates of profit upon our gas supply. We are perforce content with that slow but sure diminution of costs which follows upon an increased production, however promoted; saddled, however, strange though the fact may sound, with the liability of a larger percentage of idle plant during the summer months. The following returns, which have been most courteously supplied me by the leading officials of the companies and corporations to which they refer, support this statement:—

In Liverpool, a town by no means remarkable for a large day consumption, the difference between the smallest and the greatest weekly consumption is in the proportion of	1 to 3·35
In Manchester it is	1 to 4·00
In Leeds it is	1 to 4·00
In Sheffield it is	1 to 4·00
In the district supplied by the Crystal Palace District Company—the nursery, so to speak, of cooking stoves—it is	1 to 4·50
While in Birmingham, with probably the largest day consumption in the kingdom, it is (nearly)	1 to 5·00

Thus showing that the tendency of such consumption, in large towns at least, is just the opposite of what has been supposed.

Interesting, however, as these topics most naturally are, their attraction for us during the past year may be said to have been as nothing in comparison with that which was created, and, although in a lesser degree, is still maintained, by the advent, or, to speak more correctly, the reappearance of our terrible rival, the electric light. When, on a similar occasion, some twelve months ago, I had the honor of addressing you from this chair, the distant mutterings were only heard of that impending storm, which, gathering strength as it approached, burst with such relentless violence on that "black" autumn Monday when, in a lecture hall in this town, the wonderfull discoveries of Mr. Edison were first announced to an astonished and, for the most part, delighted world.

The incidents that followed are still fresh in the recollection of every one. Day after day prices, already on the decline, literally tumbled down, until within a very brief period gas property became depreciated to an alarming extent, and the belief seemed general that at length had come for the system of gas lighting the period of the sere and yellow leaf. Encouraged by the unmistakeable symptoms of popular favor toward the "rising sun" that were everywhere manifested, a host of electricians, with newly-furnished armor, some of it long laid aside and well nigh forgotten, rushed into the field, eager to win renown as the champions of the new creed, or, it may be, to reap for themselves golden harvests in the time honored character of Prince Hamlet's courtiers. For, indeed, it seemed as if the public, ever on the look-out for some new thing, were bent upon giving extravagant welcome to the new-comer; so that, not to be behindhand, the Governors of our Metropolis caught up the expiring Jablochkoff candle, and raised it aloft for a nine-days wonder upon the Holborn Viaduct and the Thames Embankment, erewhile transplanting it, fresh from the gay and refined atmosphere of Paris, to the uncongenial soil of Billingsgate Market. Simultaneously the idea was conceived, by an enterprising landowner, of advertising by its means an obscure watering-place; while throughout the length and breadth of the land the caterers of public amusements, true to their calling, vied with each other in their endeavors to gratify their patrons with an exhibition of the latest novelty.

During the acting of this eventful drama, what was the effect upon probably the most interested portion of the spectators of it? Gas shareholders, as we all know, were seriously alarmed, and many of them have paid the penalty of their fears. But what has been the attitude of directors and managers, whose positions and occupations should render them peculiarly fitted to form a correct estimate of the probable consequences of innovations that threaten? Have they remained steadfast to their vocation, believing that coal gas is deserving of a future, come what may? Have they, strong in the knowledge of the resources of their industry, realized the fact that competition cannot mean ruin, nor even disaster, if it should stimulate to renewed exertions, in the consciousness of the vast field left untouched by previous effort? For the most part, the answer is truly in the affirmative. Many there are whose ripe experience has enabled them to bid defiance to the fears by which they have been surrounded, or whose sagacity has risen superior to the vague expectations of the majority. But others, again, it must be confessed, have sought counsel of their fears, and

called it prudence; and thus they have been driven to temporizing—to staving off the inevitable—to running the risk of inability to meet the demands of an ever-increasing business, by withholding the means required for necessary extensions, and even to coquetting with the electric light, as though it were not mischief enough to paralyze their forces by inaction, but they must needs add to it by contemplating desertion to a hostile camp. I use the expression "hostile" advisedly, because it seems to me impossible to conceive of any middle course in this matter, in the interests either of the gas shareholders or of the public. It has, no doubt, been urged by electricians, as a reason why no antagonism need exist, that the spheres for the employment of gas and electricity lie widely apart; and with this expression of opinion we can have little difficulty in agreeing. But what, may be asked, has been the object of recent efforts, if not to wrest from our possession territory hitherto considered to be exclusively our own? Are we not justified in concluding that this attack, upon what may be called our outposts, was intended but as the prelude to the storming of the citadel? Some of our friends, however, recommend us to avoid extremities, and to come to terms with the invader. They say that there is not so much difference between us after all, and that we may very well form an alliance, seeing that gas companies were formed not exclusively for the supply of coal gas, but for that of any other suitable means of illumination. If this be so, then it is a fact that has remained latent until now; for surely the relationship hitherto subsisting between ourselves and all other purveyors of artificial light has been one of antagonism, qualified by our own apathy or indifference. What, then, is there in electricity that should make it an exception to the rule—that should encourage the belief that the two systems can be made to work harmoniously together, unless, indeed, upon the footing contemplated by the ambitious designs of Mr. Edison, of conqueror and conquered?

Whatever may come of the electric light, of this we may be tolerably certain, that for the present, at least, our energies will be best confined to the development of our legitimate business. We cannot serve two masters; and so, when people go about asking, "What are we to do about this electric light?" one is reminded of the famous reply of Lord Melbourne, "Can't you let it alone?"

Another phase of the question inevitably presents itself. In courting transformation at the hands of some indulgent parliamentary committee—if there should exist such a phenomenon—do we not betray an undue, if not altogether unnecessary anxiety as to the future? It can hardly be said, even by its most enthusiastic advocates, that the chances of success for the electric light are such as need excite apprehension in the minds of even the most timid shareholders. So much, however, has recently been said and written upon the subject of the shortcomings of the new illuminator, that I will not run the risk of wearying you by the repitition of an oft-told tale. Suffice it to say that while in special cases, as where a light of considerable intensity is required, it is likely to do excellent service; yet the impossibility of storing or measuring the electric current, its cost of production, subdivision, and distribution for light-giving purposes, are now, as ever, a formidable barrier to its general employment. It may be that Mr. Edison has succeeded in overleaping this, or that scientific discovery will eventually achieve a complete triumph over the difficulties of which it is composed; but, granting all this to be possible of accomplishment, there would still remain, in the quality of the light itself, a lurking danger to its permanent establishment, not less real because to a considerable extent overlooked in the novelty by which it has hitherto been surrounded. To the practiced eye a lack of the power of diffusion has been painfully apparent at nearly all the trials that have been made of the electric light in this country. It is this that occasioned the discontent of the Billingsgate fish salesmen; that enables the tiny gas lights on the Thames Embankment to outshine, during a fog, the 200-candle Jablochkoff lamps; that, at the Birmingham Agricultural Show, rendered almost indistinguishable objects placed only a few yards distant from a powerful Serrin lamp; and that marred the enjoyment of the spectacle at the Birmingham Town Hall a few nights ago. This inherent defect may, it is true, be overcome to a certain extent by more lavish appliances; but, having regard for all the purposes that artificial illumination is required to serve, it seems by no means improbable that, all other obstacles overcome, this one will remain to make shipwreck of the fair hopes that have been founded upon the presumed adaptability of electricity for a more extended sphere of usefulness.

Although it is probable that few people have shared in what may be termed the insane eagerness manifested by the leading journals to "bid good-bye to gas," yet the attitude of the public press generally, during the last few months, may be considered to have been fairly representative. "Light! more light!" was the craving of the material no less than of the intellectual being, long before expression was given to it by those memorable words of dying Goethe. "Light! more light!" is the meaning of that chorus of welcome which hailed the prospects of a yet greater deliverance from the bondage of night. Shall the lesson of this time be lost upon us? Shall we not attune ourselves in harmony with the chord which has been struck with so much effect, and show, after the manner of the esteemed Past-President of our Parent Association, that whatever has been achieved by electricity in the improved lighting of our streets and buildings, can be better and more cheaply accomplished by the agency of coal gas? We cannot, if we would, stem back the tide of scientific progress—far from us be the wish, or even the thought! But if we have to confess ourselves beaten, let it be by a foeman worthy of our steel, not by the cold, pale gleam of an artificial moon, possessing few, if any, of the elements of permanence. A rich inheritance is ours, bequeathed to us through the industry of our predecessors. We are charged no less by the respect that is due to their memories, than by a regard for our own reputations, to hand this down undiminished, and, if possible, augmented, to our successors. We will, then, no more indulging in unhealthy regrets for a past that has not been barren, apply ourselves with renewed diligence to our calling, that so its future and ours may be assured.

The address was well received, and it was decided that the same should be printed and circulated among the members.

At its conclusion a paper was read by Mr. T. Layton, of Redditch, on "Meter Rents;" the general policy of charging for them being the subject of an interesting discussion. It was the general feeling that it is inexpedient and injurious to the best interest of gas companies and corporations to continue this charge.

The proceedings terminated with a very cordial vote of thanks to the chairman.

[Official Report.—Continued from page 131.]

THE NINTH ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held at Boston, Feb. 19, 1879.

The President—The call is for the question. Did Mr. Greenough amend his original motion by adding the words "if called upon"?

Mr. Greenough—Yes, sir.

The President—The motion is that the Secretary be requested to furnish one copy of the returns, as tabulated by the committee, to each member of this Association when called upon.

Col. Armington—I object to that term "requested." He may do as he has a mind to do, if requested; but when he is *instructed* he is compelled to carry out the instructions.

Mr. Greenough—It should be "directed" instead of "requested."

The vote was taken upon the motion of Mr. Greenough, which was adopted.

Mr. Stedman—In my judgment, as chairman of the committee, the prevalence of the motion will probably do a good deal of injury to the perfection of the table of statistics, simply because there are persons who have put their answers in under certain conditions, and those conditions cannot be complied with under the present vote; and there are others who have not put theirs in yet, waiting for the action of the Association, and probably they will not return them. Anybody who has been on the committee, will know how delicate a thing it is to ask a man to tread as closely up to forbidden ground as he can, and not get right on to it. The committee has labored under a great deal of difficulty in considering all the delicate matters connected with this question.

It is not a matter that becomes, in one sense, the absolute property of the Association—although in strict construction it might be—because these figures are our own private records, or the private records of the companies we represent. As they have stated, each member feels an interest in them after they have gone out of his hands, and feels as if somehow he ought to retain control over them, and see that they do not go into localities where they might do him or his company an injury, which is a matter which we agree to mutually. It is not an arbitrary law passed by the Association. We agree with, and say to, one another "I will show you my figures, and you shall show me yours." It is a matter of "give and take" all the way; and if you eliminate from it the "give and take" factor, you will cut your list of answers down almost to nothing.

Mr. Cushing—There is nothing in my return that I should refuse to give, under certain circumstances, to this Association. There is nothing in my return that I am ashamed of; and I think that shows to the outside world that the doings of my company are open and free, and show a sufficient advance in the manufacture of gas, comparing favorably with the ordinary companies of the United States, especially those of the New England States.

Now, the stand I have taken has not been from the fact that I am ashamed of any returns that I am able to make; but it is the denial of the right of the individual who belongs to this Association to have the returns that are the property of each and every member. I object that my returns have

been made public—not to the Association alone—but to other parties. I am pround to say that I a willing to submit the results of my management to any Association, or any corporation, existing in the New England States. I am willing to give it to your Association; I am willing to give it to the members; I am willing to give it to any individual that may be here; but I do object to involuntary information given to other people who are not members of this Association. That is my stand, and that is what I wish to maintain.

A recess of ten minutes was then taken.

The President, upon taking the chair, said—We have a matter of interest to present at this time. I have the pleasure of introducing to you Major Dresser, the Editor of the AMERICAN GAS LIGHT JOURNAL, who has produced here to-day a specimen of lime which he will now exhibit to the Association, and will also be ready to answer any questions in regard to it that any member may choose to ask. It is a matter of a good deal of importance.

REBURNING OF FOUL LIME.—REMARKS OF MAJOR G. WARREN DRESSER.

Major Dresser—This is a matter that I happened to run across incidentally this week in New York, and thinking it might be of interest to you, gentlemen, here I have taken the liberty to bring it on. It is simply a means for reburning foul lime, so that the lime can be used over and over again. The process consists in taking the foul lime and dampening it slightly, and then pressing it into a brick of the size which you see before you on the table. Then these bricks are taken and piled up in an ordinary kiln, in a manner similar to that in which fire brick are burned. These kilns are square, having fires at each end. The flame is brought into the kiln about two-thirds of the way up, and then is drawn down through the pile of brick, taken into a flue at the bottom, and from there led off to the foot of a tall chimney. This particular specimen of lime is one where the lime had been used in the supplementary purification, after oxide of iron; so that, of course, the principal part of the sulphur had been taken out. These blocks being put in these kilns and burned, the time required for burning varies from 23 to 30 hours, as I was informed, and after being taken out, it is brought to an ordinary mixing box, like that for making mortar, where it is wet down and slacked by water, which doubles it in volume again; and then, being ordinary slacked lime, it is put into the purifiers and used over and over again. The gentlemen who were using this, and had devised this arrangement, stated that it acted equally well where lime was the only purifying material used. I know nothing about that, excepting the statement which they make. But they claim that it would answer just as well with that kind of foul lime as it does with this which is simply a carbonate of lime, having taken out the carbonic acid from the gas after the iron purification. The fires are run by coke, and they are brought up to the proper heat until this is reconverted; and then, when it is taken out, it slacks down, and becomes just as white as one of the globes of that chandelier which is above you. I don't know that there is anything in particular about it. The chemical explanation is a very simple one.

Mr. Slater—Do you know how much gas they can purify with that lime?

Major Dresser—No, sir; I do not, because they were only using it as the supplementary purification. The cost of reburning was stated to be from 2 1-2 to 3 cents a bushel. Lime, in New York, costs from 6 to 7 cents a bushel.

Mr. Slater—I have been informed that they purified about *two thousand* feet to the bushel.

Major Dresser—Their purification being doubled up in that way I did not ask the question. I know nothing about it, and am not in any way responsible for this thing except as a matter of curiosity. I know there is not a gas company in the United States, where they have foul lime which would not be glad if there was some means by which foul lime could be used over and over again. In Scotland, last summer, I saw, in the works of Mr. Hislop, of Paisley, foul lime reburnt. Mr. Hislop had an oven (an ordinary bench) where he reburned his lime in that way. I saw lime that had been burned a large number of times, over and over again, and the manager was perfectly satisfied with its results. This method of pressing it into bricks puts it in a convenient form to use; and if there is anything that could be derived from a system of this kind, by which the foul lime could be utilized, it certainly would be worth while to give the matter attention, and see what would come of it.

Mr. Nettleton—I would like to ask if, in your opinion, this foul lime could be burned in an ordinary kiln, as you burn oyster shells.

Major Dresser—That is a question somewhat foreign to this immediate proposition. I judge not; from the mere fact that these people take the trouble to put up an ordinary stamp mill, and stamp this into bricks, and pile it up, so that they can bring the heat to bear on each individual brick. The lime itself is a bad conductor of heat, and the moment you get a mass of it together, my opinion on the subject would be that it would be very difficult to get a uniform heat through the mass, so that the action of the flame could be carried to all the parts. The idea here seems to be to get it into this brick form, so that it can be stacked up with interstices between the brick, and then the heat be led down through the pile, so as to reach each part of the mass.

The President—I will state that through the kindness of the Society of Gas Lighting, of New York, they have placed upon the table a large number of pamphlets, giving a copy of the paper read by Mr. Eugene Vanderpool, of the Newark works. These copies are for distribution, and any member is at liberty to help himself to a copy. I have extended the thanks of this Association to the Society of Gas Lighting of New York for their kindness.

Col. Armington—I want to say, with regard to that lime (I never saw it before, and did not know anything about it), that some twenty years since—which is not a very long time—Prof. Chase, of Brown University, tried an experiment of that kind at the works of the Providence Gas Company. I think that a statement of the experiment which he made, and of the information which he derived, is on record at the Providence Gas Company's office now. I think Mr. Slater, the secretary of the Providence Company, will find it when he comes to look for it. I think, now, at this stage, when the subject has been introduced here, it would constitute a very valuable document to be brought forward; and I think that at our semi-annual meeting we may know something about it, for it certainly would be a great saving if we could produce anything from the reburning of our lime which could aid in our purification process.

Mr. M. S. Greenough—Last October I had an opportunity of attending a meeting in New York of the American Gas Light Association. Advantage was taken of my presence there, in the absence of a gentleman whom I see before me to-day, to question me on the subject of the French gas works. I had the pleasure of meeting the gentleman to whom I allude, Mr. Forstall, in Paris last year, and I hope he will give us now some idea of the impression left on him by his inspection of the works which he visited and inspected so carefully in Paris and in London.

The President—I have the pleasure of presenting to you Mr. Forstall, of New Orleans.

Mr. Forstall—I came here gentlemen, entirely unprepared to speak on any subject. I took notes in Paris, intending to throw them into the shape of a paper for the October meeting of our Association. On account of circumstances which the majority of you understand, it was impossible for me to leave New Orleans to attend the meeting; consequently those notes remain just as I prepared them. At the same time, I should be perfectly willing to answer any questions that any gentleman might wish to put with regard to any particular part of the process and manipulations in Paris, and give my general impression of what I saw there. I do not know that there is any special part connected with the management of the Paris gas works that we in this country could imitate with any chance of benefit, except, perhaps, their system of furnaces for heating retorts. At most of the Paris stations the coal is carbonized by the Siemens furnace, or a modification of it which has since been adopted as an improvement, by which one furnace is made to serve two benches. They claim an economy of about 15 per cent. of the amount of fuel employed, One of their engineers put it in this shape: That the whole economy which he could make out of it was one additional retort for each oven; that is, the same amount of fuel used under the old process for a bench of seven retorts would carbonize an additional quantity of coal, which could be put in an additional retort, in the space formerly occupied by the furnace. That, they thought, was about the upshot of the matter. But that was gained at a very large outlay and expenditure of capital. At one of the works, the La Villette works, where the experiment was first tried, it was found necessary to adopt this furnace, and to scoop out and excavate the soil to the depth of 18 feet over the whole area of their works—I suppose over 100 yards square was actually scooped out to the depth of 18 feet; and these furnaces were applied under their ovens. Well, the engineer in charge of those works told me he did not think the company would ever make the interest on their expenditure. At the works at Vaugerard, where that furnace was adopted, they went to work very economically in an improved way. Still, I think, there is a great deal of complication about the system. This plan shows in the photograph before me an improvement on the furnace. I think there was a furnace which I did not see in action, but which was very well recommended. It was adapted to four benches, requires no excavation, acts on the same principle—that is, first making carbonic oxide, and then, by the admission of heated air, at a certain portion of the furnace turning that into carbonic acid gas, and making thereby perfect combustion. I think that is the condition which we, in this country, should attend to, not only in respect to the amount of fuel used (in which we are behind our English and French neighbors), but, at the same time, in relieving the stokers from the hardest and most arduous part of their work, which is the clinkering of the furnace. In our climate, especially

in the South, it is by far the hardest work of the stokers, and in the summer it is very difficult to get them to do it, on account of the length of time they have to be subjected to the heat of the furnace. With regard to the purification I was rather disappointed. In Paris they have no "scrubbers," and they have no "washers"; the gas, after leaving the retort-house, passes through a set of horizontal pipes, generally from twenty to thirty inches in diameter, which are placed in horizontal lines, one above the other, with a jet of water flowing over the outside of these pipes. They are in the open air; and it overflows from one side to the other, and the condensation is done entirely by this surface evaporation, and, as far as I could judge, was very thorough, but requiring a large quantity of water. The gas passes through the purifiers in a series of from eight to ten. The first purifier is filled with sawdust, which is dampened with water, and those purifiers filled with sawdust answer the purpose of scrubbers and washers. From these the gas passes on to what corresponds with our lime purifiers; but they use the Laming mixture of sawdust and sulphate of iron, with a little lime mixed up in it. All the ammonia which they gather from their gas is washed out from this sawdust after it becomes saturated. They raise the cover, and with the hose sprinkle water on this sawdust, and run out the liquor, which is highly charged with ammonia, so much so that I could hardly stand in the room where the operation was being performed. That seems to be the height of perfection that they have reached in the matter of purifying gas. The exhausters which I saw worked very well. They are all on the reciprocating cylinder and piston plan—more like pumps. They have no rotary exhausters at all; but where they excel us is in the utilization of the residuum products; not only does nothing go to waste, but they make the most of every one of the products from tar down to ammonia. They manufacture gas stoves, coke stoves, gas engines, all the aniline dyes, anthracine, alizarine, all that can be made out of the tar they make, and their returns from these products largely exceed the cost of their coal; so that their gas costs barely the wages of the men employed in the works. This, in a few words, sums up the result of a month's study at the Paris works. Of course, I had a great many details which I intended to to put on paper; but the upshot was this, that, so far as carbonization was concerned, we could, by adopting their system of furnaces, save considerably in our fuel. And when our cities increase in size, so that there is a market for all these residuals products, we will probably be able to do as they do. At present, it would not pay here because there is no market for the manufactured article.

I was rather disappointed, for I expected, in going to Paris, to learn a great deal. I am sorry to say I did not learn very much; but I was better pleased, on coming away, to know that we were not so far behind them as I expected when I left home.

Col. Armington—Of these supplementary furnaces, of which our friend from New Orleans has spoken, I had a drawing sent me some time since, for applying these furnaces directly to the benches. I have a drawing, and some photographs, showing how they are at present applied in the city of Baltimore on the works there. They seem to be working there very nicely indeed. They have reduced their time of charges from four hours to three and they are working off well burned in a retort 12×20, 8 feet 6 inches long, 200 pounds of coal in every 3 hours. What they claim particularly for them is that very fact; they do not claim so much a saving of fuel as they do their being able to carbonize this extra amount of coal. I had this, and was about getting ready to put in one of these furnaces when I was stopped by some other cause, and should have had some of them in operation now; and I should have been able to have spoken of them as to whether they were as economical as they are represented to be. But here is a drawing, which you can examine, showing the whole application of the furnace, and these photographs, showing the works in which they are placed. I have not doubt that they will prove very successful, and that, by the generating of carbonic oxide, and simply burning it under the benches, a great saving, both in labor, carbonization, and in fuel will be effected.

Mr. M. S. Greenough—What is the cost of putting in one of these?

Col. Armington—The inventor estimates the cost of putting in one of these at $400 per bench. I think the benches will be applied differently one of these days from the way he now applies them, for I think the mechanical arrangements are very defective. The manner in which he handles the covers is done by main strength instead of mechanical means, but, as far as the idea is concerned, I think he has just hit the nail on the head.

The Secretary—Do I understand you to say that with that appliance the charges are made every three hours?

Col. Armington—Yes, sir; of two hundred pounds to each retort; and one man, with these benches, takes care of sixteen fires, and coke is drawn simply from two retorts into these benches by means of a hopper—the two lower retorts. If there has been any missing of charges, some more green coke is added to that, and then the thing is closed up air-tight, and the draught is applied from underneath. It will be seen from the drawing that the arrangement of the pipes is such that whatever atmospheric air reaches it—which has passed through between the walls of the furnaces and the outer walls—at the point of ignition make a very high heat, and of course works more economically than it would by admitting the atmosphere from outside

The Secretary—Is there a blower applied?

Col. Armington—No, sir; no other appliance. We were shown at the end or top of the benches the under flues three or four feet above the top of the arches. We were shown the fire when the furnace was open and the hot coke was being drawn from these lower retorts into it. Then the atmosphere was applied so freely through these pipes that the flame of carbonic oxide could be seen issuing from the furnace as in our works. When the lids were closed and the draft regulated so that no atmosphere was admitted except through these pipes, there was nothing to be seen on the top of the stacks at all. There was apparently an entire absence of all heat, showing that it was being utilized in the benches. I have no doubt, myself, that it is a very good thing for us to look after; but just at present we are not prosecuting the matter any further.

Mr. Dwight—Is it necessary to have the basement space?

Mr. Armington—No, sir; it is not. In the Baltimore works the floor was a simple, solid place, like any other retort house—not having any cellar at all; and these excavations were made, from time to time, as he pleased to put these furnaces in until he had sufficiently tried it. I think he had some fourteen of them in use.

Mr. Stanley—There were twenty benches of them fitted out. He was using sixteen, and he was to make the entire excavation in his house.

Mr. Armington—He said he made this excavation, and applied these furnaces, and still prosecuted his work at the same time. Of course, it was under very disadvantageous circumstances; but he said he had no trouble in doing it. The day on which we were there was on Monday. As he was missing on that day, we did not have the opportunity to see the high heats that he usually carried; but Major Dresser, who remained there, told me that he saw those heats, and saw this amount of coal charged into the benches, and drawn each three hours. Of course, if that can be accomplished, it must be a great saving to us. His books show that the season previous he was using seventy retorts, and making a certain amount of gas; that he was sending out just about the same amount of gas this year, and had in use less than fifty retorts; so you can see he was making a great saving all around, both in labor, fuel, and everything of the kind, since I had been there to examine these appliances, if you remember, we had published in the American GasLight Journal the German plan of doing the same thing. It seems to be entirely different from Mr. Dieterich's; but whether it is any better in operation we have got yet to find out by applying it.

Mr. Nettleton—Does the $400 include the charges of the patentee?

Col. Armington—It does not. It is simply for the fitting up of the bench.

Mr. Nettleton—What is his charge?

Col. Armington—That remains to be definitely stated. It is to be talked of hereafter. I have also brought along, by permission of the gentleman from whom I have just bought an apparatus, a couple of photographs that he gave me. I told him that I was so pleased with the operation of the machines that I would like to bring them. I had been contemplating the burning of breese, but could not do so on account of the expense. I would have had to buy a blower, which would have cost about $75, and it would cost me about $100 more to run the shafting to the necessary place; and then the additional cost of some piping, which money I did not feel like laying out; but a short time since I was made acquainted with the fact that an injector, on a new plan, had been made for the burning of breese. I examined into it, and as soon as I saw it was satisfied with its utility, and had one applied to our boilers, so that we are now (or should be, had I not made a very good contract for disposing of the breese) burning breese entirely; we do it without the use of any blower, or any shafting, or running of the steam engine, simply, by the injector. I have photographs of the injector here which any engineer can examine who wishes to turn his attention to breeze burning.

The President—Our friend, Capt. White, of New York, has a matter which I understand will be interesting to the Association. Capt. White, we will be pleased to hear from you.

Capt. White—I referred to a letter I received from Mr. Wood, engineer of the Syracuse Gas Light Company, a few days ago, at my office, in which he describes a very simple apparatus which he has applied in his works for the elimination of ammonia from his gas. It is not patented, and he says, at the foot of his letter, that he requests me to present this to the attention of our Yankee fellow gas members, that they may adopt it if they choose. I saw it at his works in October last. It struck me as being a singular piece of apparatus. I asked him what it was, and he described it at

that time. I received this letter from him, which is dated the 15th, and which I will read; and then I may be able to answer a few questions, though I did not enter into the matter very carefully at that time. The letter is in this language:

"GAS LIGHT COMPANY OF SYRACUSE,
SYRACUSE, N. Y., Feb. 15, 1879.

"FRIEND WHITE:—Knowing how much interested you are in all things appertaining to gas matters, and having had an experience of some months with a dry scrubber of my own devise, and with such favorable results in taking care of the ammonia, that I desire to tell you about it.

"Some years ago, finding that our condensers were of too small capacity for our make of gas, and, being limited for room, could not enlarge them, I devised and erected a dry scrubber, made of wrought iron, 12″×24″×24′ long—this box being divided into compartments by wrought iron plates 8″×24″, placed 24 inches apart, and made fast to the inside of the top and sides of the box, thus leaving a space at the bottom of the plate of 4″×24″, for the passage of the gas. These compartments were subdivided by a plate 7″×24″, made fast to the side only, and so placed as to leave a space at the top of the plate of 4″×24″, for the passage of the gas, and a space of 1″×24″ at the bottom of the plates, to accomodate the flow of ammoniacal liquor, etc., as it condensed from the gas.

"You will see that we thus had 24 partitions, and the gas in its passage through the box passes alternately over and under the plates or partitions, except a small portion passing under the intermediate plates. At first we set up two of these boxes, one over the other—the gas entering the top box at the end, and passing through it to the opposite end, where it is connected with a flanged pipe to the top of the lower box, which the gas enters and passes through to the condensers. The flow of gas in its passage through the boxes being constantly broken up and turned over and over, thus breaking up all the globules of tar and liquor, and liberating the gases. The boxes being set so as to carry all of the condensation along in the direction of the flow of gas, the gas is thus brought in contact with the ammoniacal liquor every time it (the gas) passes under the partitions.

"This arrangement of the two boxes operated so satisfactorily that last fall we doubled their capacity by erecting two additional boxes, constructed and arranged on the same plan, since which time we gradually reduced the quantity of water we had been using in our jet washer, until we have entirely dispensed with its use, and we are now running without water. The combined length of these four boxes is 96 feet, and our average daily make 250,000, and since discontinuing the use of water we have a trace only of ammonia in the gas before it enters the purifiers, after which there is *none*. We have passed the gas through (your) "Red Litmas Water" for *two hours, without skowing a trace of ammonia!* How is that?

"If we could have set up these scrubbers so that the gas would flow through them in the opposite direction, so as to meet the flow of liquor, it would no doubt be more effective, and would not require as much length as we have in these boxes. As we were situated, we could not do this; but still, they take up but little room. All that is required is the desired length of room, two feet wide, and of a height sufficient to accommodate the required number of boxes and their connections, giving the boxes the necessary grade to carry off the condensation.

"From my experience, I am of the opinion that a small quantity of water can be introduced into these boxes, taking out *all* of the ammonia—leaving none to be taken out in the purifiers. This, you see, is a much less expensive and more simple way of extracting the ammonia from the gas than the new large and expensive scrubber being put in the gas works about the country. The St. John and Rockwell, and other dry scrubbers, create a heavy back pressure, which is objectionable. This makes no back pressure whatever.

"I have inflicted a longer letter on you than I intended, but you know how it is when a fellow has anything to say—particularly a gas fellow; and I would advise you to take it along and devour it on your way to Boston, so that you can tell those New England fellows about it (*personally*, not in the meeting)—that is if you think, as I do, that it is a good thing. Let them have the advantage of it if they desire."

"Yours, etc., WOOD."

In October I had business in the city of Syracuse, and naturally visited the gas works, and saw my friend, Mr. Wood. He then showed me the boxes. They were simply long boxes, as he says here, 24 feet long, 12 inches deep, and 24 inches across—peculiar looking arrangements. The gas enters at one end, and passes under this one and over that one, and in passing under the partition is driven over the surface of the condensible matter. Just how efficient it was I did not stop to definitely ascertain. This letter is entirely unsolicited from Mr. Wood. It came to me in our ordinary correspondence. As I supposed it might be interesting to you, I presented it to your attention. It is something you can try at no expense. It is entirely unpatented; and the reputation of Mr. Wood as a successful gas manufacturer is so well established that it is unnecessary for me to say anything in that connection, and the gentlemen can consider the matter at their own leisure. Certainly, if it is as successful elsewhere as it is with him, it is a cheap way of getting rid of the ammonia.

On motion of Col. Armington the thanks of the Association were prerented to Mr. Theobald Forstall for his instructive address just made.

The Secretary—Col. Stedman has handed to me a form of monthly statement, which will also do, with a little alteration, for those who make up their accounts once a quarter. It is in a very good and condensed form, I should judge. I will pass it around for you to examine.

Mr. Stedman—Those little forms I laid on the table for the reference of members, if they desired to see them. They are simply copies of the printed returns, and they are made under the separate headings that are found there; and their pertinency will be easily seen. I do not offer them here in any spirit of egotism, thinking that I can instruct the members in getting up such returns; but it struck me that it was a very simple and easily applied form. In carrying out the figures in the last column there will be afforded a ready means of reference, from time to time, and engineers will see very readily how they can reduce their expenses in some point or other.

In regard to the returns, I want to say one word more, and that is—that it is desirable that, in some respects, we should have a uniform standard of figuring in the matter of the illuminating power of the gas. There is such a wide difference of standard just now that it is almost impossible to compare the returns that different companies make with any degree of intelligence whatever. I should suggest to the Association that they adopt some standard burner. I am aware the law of Massachusetts allows everybody to use the burner that will give the best perspective effects to his gas. That was a law obtained through the instrumentality of some of these gentlemen who are present here to-day. But we all know that the commercial value of gas does not depend upon or follow exactly its photometric value. We hardly ever see large Argand burners used for the illumination of large spaces; simply, because the light from them is not so diffusive as from the "batwing" or "fishtail" burners.

No reference is made to any particular burner. I think it will be desirable that the Association should express, in some way or other, its preference in regard to some particular burner say "No. D," which, I believe, is the standard used in the Board of Trade, of London—the "Referee's burner"; I do not know what the standard is in New York city. If we only adopt a uniform standard, it would not make much difference what it was, as these returns are made simply for the purpose of comparison one with the other.

There are one or two other things which it is necessary should be more definitely determined in order that our returns should be of a more intelligible and useful nature. As "to the average number of retorts in use," there is quite a difference of usage in making out returns. Is a retort "in use" when it is under fire, or only when charged? Some give us figures in one way, and some in another. So far as regards the consumption of coke, it is a matter of indifference whether charged or not. It is the same about firing—unless charges are temporarily suspended. It is the practice of some to report only the retorts that are charged, and to deduct the time that the retorts are idle. Multiply by six to produce the number of retorts per diem. Multiply by thirty for the month, deducting the charges that were suspended, and you have the total for the month. Divide by six, and you have the number actually in use; that would cut off a fraction of the actual number under fire all the time, and would give the exact figures in regard to the retorts charged at the time. I only throw out these suggestions in order that members may cogitate upon the subject, and, finally, get at some degree of unanimity in making their returns.

Mr. Wm. W. Greenough—I did not expect to be called upon, at this date, to defend the Massachusetts standard of gas. I think we fought that standard through at least six successive legislatures, and came out victorious. As I had the fortune, or misfortune, to be the author of that standard, I think I must say something in answer to the gentleman, if it be but a few words. The result, however, of the whole thing has been that the British Parliaments have adopted the Massachusetts standard, *i. e.*, that they have required that every gas shall be tested by the burner adapted to it. Our friend, Mr. Sugg, has gone on inventing a series of burners to adapt them to the gases made in London and other parts of England. The principle upon which the gentlemen, who were interested in the original Massachusetts law, acted was this; that the value of the gas was in itself and not in the burner; and to show that point it must be consumed under conditions ensuring, so far as practicable, perfect combustion. So long as different companies in the state were only able to get certain coals, and were only able to make gas with certain illuminating qualities, it was not fair that their gas should, in measuring its mercantile value, be tested by a burner that would fit either a higher or a lower grade. Thereupon, they adopted the simplest and most obvious principle—that every gas should be tested

by the burner suited to it. I did not know until the gentleman spoke that it was desirable to go back to the old original standard. There is no burner which is suited to all the gases which are made in New England.

Mr. Stedman.—I beg to state that I did not think that it was desirable to undo what Mr. Sugg had been doing for so many years. A burner for the testing of gas that has high illuminating qualities, with abundant apertures for the admission of air, would not be proper to use in the case of a man making ten or eleven-candle gas. It strikes me, though, as being desirable when there was generally a similar range of illuminating value, that one standard burner should be adopted. A burner that is best adapted to the testing of twenty-candle gas of course would not be at all fitted to bring out the best results from ten-candle gas. But the returns show that the great majority of gases made range from fifteen to sixteen-candle power. I do not know what the average figure would be. Taking out the very excellent gas which the gentleman who has just spoken makes and delivers to the city, I think the other companies would average somewhere in the neighborhood of a fraction above sixteen candle power; so it would not be unjust to adopt a uniform standard for most of those companies.

Mr. W. W. Greenough—I see no objection to companies who make sixteen candle gas agreeing among themselves upon the burner they find most satisfactory to their case. The Sugg burner is the burner which they would take, obviously, for the trial of their own gas. I do not see the use of any general legislation, or any general advisement, upon the subject by this Society.

Col. Armington—Mr. President, this subject I have been considerably interested in lately. Some time ago I remember seeing an article in the Gas Light Journal, dated from Portland, Me., (I suppose our friend, Mr. York, may be able to tell us something about it), in which the author speaks of that very thing. He says he does not wish to be brought into a position that makes his gas show poorer than other people's. He says he has been informed (whoever the writer is) that some persons test their gas with one Argand burner, and some with another. Now, the standard set up in the city of New York by Mr. Love for the testing of all gases there, is the old standard or "fifteen-hole Argand" burner. Of course it makes it fair for them if they agreed to furnish the city with a certain gas of a certain standard, to be tried by that burner. We all very well know, as was shown three years ago in this Association, with regard to your own case and the Sugg burner, that it was possible to raise that standard materially by the use of the Sugg burners. But what was complained of in that article was that very fact—that there was no standard; some engineers having one, and some another. I saw afterward in the Journal another communication from California, in regard to that very thing. The argument used by that engineer was that he asked why, if he could make merchantable gas of fifteen-candle power, by showing it up with one of Sugg's burners, he should not be allowed to do so, and call it fifteen or sixteen-candle gas, the same as the man who uses the ordinary burner. I think that Col. Stedman has broken the ground in the right direction. I think that, with a single exception, perhaps, (and I hope my brother New England Engineers will not think I am making any remarks to reflect upon people here)—with the exception of the Boston Gas Light Company, the old fifteen hole Argand burner was adopted as a standard to show all these gases by, and they would then all know that they were testing by the same standard.

Major Dresser—Inadvertantly Col. Armington said that Mr. Love had set up a standard in New York. He is mistaken there, as Mr. Love has not set up any standard. The standard was established by the powers that made the contract with the gas company, and he simply tests according to the conditions of the contract. He has no option as to what burner he can use in testing the gas in New York, and his duty simply is to see how the gas compares with the terms of the contract made between the city of New York and the gas companies furnishing the gas. That contract calls for a given illuminating power, where so much gas is burned through a fifteen-hole Argand burner. That is merely just to Mr. Love, because I know the question has been raised sometimes—why Mr. Love uses that burner. He has no option in the matter. He is simply performing the duties assigned to him under the cotracts

Col. Armington—I know that is so. I wish to show, with regard to that very thing—which is what should be known by every gas engineer in this country—that the standard was adopted by Mr. Roome and Mr. King, of Liverpool, after many experiments in Mr. King's laboratory, it was adopted as the standard there; and the parties drawing the contracts for the furnishing of the gas for the street lights in the city of New York simply took that old standard, and by it Mr. Love was governed.

Mr. Forstall—I think that this is a question which is very important to all gas makers in the United States. We have no means of comparison by which we can show what we do as compared with what any of our neighbors do, and know what we are talking about. Now, I beg to differ from Col. Armington, with regard to the standard burner. What is the fifteen-hole burner? What diameters are your holes? That alters the whole illuminating power of the gas. In England, until 1870, their standard burner was a fifteen-hole argand, with a seven inch chimney; and, when the London Gas Act was amended, the question of a standard burner came up again. A great deal of opposition had been made to the fifteen-hole argand, because every company was testing with it, and the results were different in every case. The burner had fifteen holes, and it had a seven inch chimney. It varied with the different qualities of gas, according to the manufacture, and the different size of the holes. Mr. Sugg came forward merely to relieve that deadlock, and he made a burner which could be described—for the other burner could not. His burner had holes of a certain diameter, and had a certain diameter of opening in the annular space for air. It had a certain height of chimney calculated in proportion to the annular space. We are entitled to all the light we can get out of the gas. The English law says the burner shall have certain holes, of a certain diameter, and a certain height of chimney. That burner was adopted with reference to the standard as made, which is deposited in the Weights and Measures Office, in the city of London. A million of those burners can be made, one exactly like the other, and the results will be identical. The English gas law goes further, and says that the gas shall be tested by this burner, or any other which shall give the best results, and be practical for ordinary consumers. After we have done that I think we have done all the public can ask us to do. We are entitled to all the gas we can get through a burner which ordinary consumers can use. Why should we go back forty years and use a burner which gives only half the quantity that ours can give, simply because it was adopted as a standard when there were no better burners in use?

There is no reason why we should adopt it; a great many companies are not under any restriction as to the illuminating power. The lawmaker, when we are all put under his fictions, will take the burner in general use at his time. If we tie ourselves down to an imperfect burner, we are entitled to no mercy in legislation, and will get none, if we say we have neglected it ourselves, and have not taken advantage of it. I think, under the circumstances, this Association, and the National Association, should declare for the "Referees burner." We can then compare our results with the English results, which will not do us any harm; and we can compare our own results with those of one another. I do not see any objection to it; and if there is no reason for clinging to the old burner, except that one, two, or three companies now use it, I do not think it is fair for the greater number.

Col. Armington—I agree with the gentleman last up exactly. I do not want to set up the old "fifteen hole Argand" as a standard; but I say it is used in this country more as a standard than any other burner. Take a city like Brooklyn: there are six companies furnishing gas in that city, both to private consumers and to public buildings and the street lights. Now we are simply asked by the board of public works to furnish them with a fifteen-candle gas; that is all that our contract requires. Now suppose that my neighbor chooses to set up the referee burner, or the burner of Mr. Sugg that will give him the best results, and I am confined to the old method of testing—simply because engineers in neighboring cities and elsewhere regard that as a standard. Suppose I am confined to that, and am obliged to furnish the public lamps with gas that will furnish fifteen-candle power by that burner, and some other engineer sees fit to use a different kind of coal, or to take more out of it, and by the use of an improved burner he satisfies his conscience—by taking out his fifteen-candle gas. Now, there is just the point; but it is the point made by Col. Stedman, that if this Association declares that any engineer may use any standard he chooses; and our friend Mr. Gerould can not compare notes with our company in Brooklyn, because they will disagree. But what you do want is to set up that they may have this privilege, or be confined to the referee burner or old fifteen hole Argand. You do not suffer so much in this city, because there is only one company here. I do not know that you are even restricted by a board of public works as to the illuminating power of your gas. But with us in Brooklyn—we are required to furnish the city with gas of that standard. Here is my friend Dr. Sloane, who is engineer of the Citizen's Company. He may say that he satisfies himself by using the referee's burner. He can take what he chooses out of a ton of coal, and furnish the board of public works with fifteen candle gas; while I say that my standard is the old fifteen hole Argand, and I must be lenient to myself in what I take out, and furnish so much more. It is a good place for us, I think, to make a declaration with regard to a standard.

Mr. M. S Greenough—I have given some attention to the subject of burners for ten years back. The gentlemen here, I think, are all correct in their statements. I do not think there is the least doubt that we are entitled to all the light which can be extracted from gas, when estimating its value, in any way whatever, for any purpose. But, at the same time, it may be of interest to us as an Association to settle on some one burner which we shall habitually use in making experimental tests. There can be no possible objection to that; and in doing so we had undoubtedly better select the burner which gives the best light; and the burner that I think is called "D" in the series made by Mr. Sugg, running from "A" up to "N," is the burner which I think is adopted by the London companies in their tests of gas as best adapted to the gas which gives a light of sixteen candles. I cannot see any reason why we should go back to the fifteen hole Argand for the purpose of testing our gas. Let us make a step forward, and select burner "D." I think it makes very little difference whether we use "D" or "E." If the motion be made that the New England Association, in making tests for comparison among themselves, suggest burner "D," in the special series, I would be glad to vote for it.

The President—Which is the burner used upon the "illuminating power meter?"

A Member—That burner is only to burn four feet.

The President—I was thinking it was letter "D" that was used there.

Mr. M. S. Greenough—No, sir; my impression is that that is "B" in making tests. I know, in making a series of tests the other day with different

burners all the way up in the series, the burner "B" burned very close to four feet. I rather think that is the burner.

Col. Armington—There is one point made by Mr. Forstall which I think we should bear in mind. When he speaks of legislation which probably is to come, the truth is we are entitled to just the amount of light we can get from any burner. If this Association will make that declaration—that this burner "D" should be adopted by these engineers, and they recommend it to the engineers of the country, then we shall have a standard to go by. And we do not know, when we are publishing proceeding of this kind, who and what number of men will read them; and it may turn out on that very thing one of these days, in some state legislation, that a man saw that a standard had been adopted, and if it was a proper standard, and the standard which had given the proper amount of light, it might do us a good deal of good; when, if we should fail, and do it the other way, it might possibly do us a good deal of harm. Whatever we put on record we should be very careful about, because it may hereafter affect us in the way of legislation.

Mr. W. W. Greenough—I would like to make a suggestion on this point, and inquire whether, when the experiment as to illuminating power is made, it would not explain itself to every gas engineer if the burner was stated—the letter of the burner used in every test—put it on such and such a burner, gave such and such results. Then everybody who sees that result knows exactly the circumstances under which the test was made.

Mr. Lamson—I do not believe in this matter of testing all gases by one burner. Every company making gas ought to have the full credit of the gas they produce. I do not believe their gas ought to be tested by any single burner. I believe in the suggestion of Mr. Greenough, to put the name and number of the burner against the statement of the test made. That is the only correct way.

Col. Armington—I can see great objection to that; for engineers that, probably, is the true thing to do. But just imagine a thing of that kind getting into the Massachusetts Legislature, and one wise head saying to another, "here are these companies fixing this thing up among themselves. They set up that standard because they alone possess it. They get at the largest amount of illuminating power from the "D burner" and, therefore, they adopt it. We will go back to the old fifteen-hole argand; that they have got to adopt and get a richer light." If you leave this thing out, these people will not be acquainted with that fact. If we say that we recommend a certain standard, it is adopted; everybody proceeds from that without the "D," or any other letter.

Mr. Lamson—This very thing which Mr. Greenough speaks of has been fought over and over again in the legislature here; and the ground taken that every gas should be tested by the burner best adapted to it was the correct one, for it is certainly fair that every gas should be shown to the best advantage, and not be prejudiced by being consumed in a burner not adapted to it. The members of the legislative committee have been convinced by these arguments, and the law has stood for years.

Mr. Cushing—I have not been so long in the manufacture of gas as some other people; but I know, before I had anything to do with the manufacture of gas, Mr. Greenough, and the former agent of the Lowell Gas Light Company, had something to do with the law that was gotten up with reference to this subject, as it stands on the statutes of Massachusetts. I understand that the law is, that, in any city or town of this state, where gas is manufactured, the burner used shall be the one best adapted to the illuminating power of the gas. Now, we all know that gas manufactured from different kinds of coal is best adapted to the kind of burner that is to be used in accordance with the production that is made from that kind of coal. Newcastle coal will produce you a certain kind of gas, and Westmoreland coal of the United States will produce another, and the Province coals will produce still another. The gases from all these coals, according to the Massachusetts standard, are to be measured by the burner best adapted to that kind of gas. Our legislature of Massachusetts has wisely, I think, adopted the burner that shall be best adapted to the gas that is manufactured in any particular city or town, and to the coal from which it is manufactured. Now, I do not see how any one standard burner can measure the quantity and quality of the gas that we make out of the different kinds of coal that we use. Consequently, I do think that the law that we have adopted here in Massachusetts, and which has been adopted in Maine, and in the kingdom of Great Britain, is the right, true, and proper law for all gas companies to be governed by; and that law, as I understand it, is—that the measure of the quality of gas shall be according to the burner that shall be best adapted to its quality. I cannot say that any one city shall make a standard for any other city. I know that I manufacture a gas that today is different from the standard of gas that I made two or three years ago; consequently, I do say that the law under which I am working is the best law under which I possibly can work. I do not want any other.

The President—Gentlemen, there is no question before the meeting. The Chair has allowed the discussion to take a rambling form.

Mr. M. S. Greenough—I was starting to make a motion about the burner when I was stopped. Further reflection convinces me that we cannot do this thing satisfactorily. If we were all making gas from the same kind of coal, it would be one thing. But, as I understand it, a gentleman who is making gas chiefly from coal and partly from oil gets gas of a different specific gravity from that gas which is made entirely from coal. In that case he cannot test his gas by the same burner that the other can. Again, if you are making 16-candle gas from coal, you can test it by one burner; if you are making it from coal and oil, you will have to use burner "E" or burner "F" to get that gas. I am not familiar with that manufacture. But if a man does not get all the candle power from gas that it is capable of giving, in making his return, he must take the consequences. He is at liberty to use any burner he can. I do not think that we can establish a burner for all grades of gases.

Col. Armington—The gentleman's remarks do not apply to me at all. I have always been a supporter of coal gas in this Association—notwithstanding my friend Mr. Lamson has fought me a good deal.

Mr. Stedman—What led me to bring this question before the Association was simply the fact that there seemed to be in some cases, a wide discrepancy between the returned value of the gas and that which the State Inspector gave to the same gas. It would seem that where the gas was very nearly of one quality, and made from coal in the ordinary way, that we should have some standard burner by which we could be assured that all had been tested alike, for the purpose of comparison. I have no objection at all to adopt the burner that will give the best photometric results from the gas, although I question if photometric results are not very deceptive indications of the commercial value of gas. Those of you who have noticed the experiments recently reported in the London journal, to determine the width of the zone of greatest intensity in the Argand flame, will remember how small a proportion of the light produced the greatest effect on the screen, and will readily infer from this result that there is a chance for a fallacy in estimating the value of gas simply by its photometric effect in a dark room. I doubt whether such an estimate is as correct a criterion of its value to the consumer as an estimation by the jet photometer. But for the purpose of comparing the gas of one company with that of another, it is evident that the use of a uniform standard is the only means by which we can arrive at an accurate and intelligible comparison. In regard to the experiments I have referred to, it is evident that the apparent illuminating power of gas can be brought up considerably by carefully nursing the band of intense light, and causing the air to impinge on the flame in the right place, and proper proportion. But our consumers would fail to perceive the enhanced intensity in their fishtail and batwing burners. For that reason my suggestion is that, while we might tickle ourselves in the photometric room with the belief that our gas possessed a degree of illuminating power of from 20 candles upward, when the State Inspector would only accord 14 candles. We must come down to business in our talk with each other, and be able to say, "My gas is compared with yours in making the returns for tabulation, by using the same measure of value that you use;" just as one would say, "My yardstick is precisely like yours, and consequently my measure of dimension is that which you employ." However, I should be perfectly willing, on the part of the committee, to accept either one standard by which we could all report the value of our gas, or, if that was deemed unfair by any company, to simply state the mode by which the illuminating value was obtained.

Mr. Forstall—The objection made by Mr. Greenough can be made to the English law as well. That provides that, for common coal gas which ranges between sixteen and twenty candles, this "referee" burner shall be used; but for gas above that the flat flame burner is used, which gives the best results for that kind of gas. But within the ranges of gas made in this country—certainly not more than four or five candles—the referees' burners will give the best results. The advantage of that as a standard is that they are all alike. Any two of them are alike; and when you are comparing the results of two works you have no difficulty with it. If you have exchanged burners you would find a difference in your gases although they might be apparently identical.

Mr. Greenough—I did not mean to imply that the candle power of this oil gas was to run up to twenty candles or more. A great many gentlemen are taking out a very large quantity of gas from their coal, and then enriching it with naphtha. The specific gravity of the resulting gas being considerably greater than that of coal gas of the same illuminating power. Sixteen candle gas made from coal alone would have a specific gravity of .420; that made with naphtha as an enricher would be .520. I do not think you can burn the gases in the same burner satisfactorily.

A member—The consumers are using the same burners, and using both gases.

Mr. M. S. Greenough—That is true; but in determining the candle power of that gas, if they wanted to burn the naphtha gas in burner "F" I have no objection to their doing so. If it should be the sense of the meeting that burner "D" should be the one habitually adopted in making experiments, I should be willing to offer that motion and vote for it.

Mr. Forstall—It might read, simply, from "coal gas."

Mr. M. S. Greenough—It does not follow because the consumer does not burn his gas rightly that the company is responsible for it; after the company has manufactured it, if they do not properly consume it it is not the company's fault at all.

Mr. Forstall—I contend that the "referee's burner" would give you as good an index for the value of your gas, and a better as a means of comparison.

A member—It would be in certain arrangements; but among the burners of Mr Sugg's there are those adapted to gases that range from fourteen to twenty candles; he has made burners for these different kinds.

[To be concluded.]

Reduction in Price of Gas at Lyons, N. Y.—On the 1st of last month the price of gas was reduced from $4 to $3 per thousand feet by the Lyons Gas Light Company.

Additional Water Supply for Newark, N. J.

The following abstract of the report of the civil engineers, Messrs. J. J. R. Croes and George W. Howel, upon the feasibility of increasing the supply of pure and wholesome water for the city of Newark, was compiled by Mr. T. T. Kinney, of the Newark *Daily Advertiser*, and appears in that journal March 11, 1879:—

To the Newark Aqueduct Board:—The undersigned have the honor to submit the results of the surveys and examinations made in compliance with your resolution of June 5th, 1878, to ascertain the relative cost and value of various schemes for furnishing an additional supply of water to Newark.

A further resolution of your board instructs us that provision should be made for a supply of at least thirty millions of gallons per day, and that sources capable of furnishing an increase up to one hundred millions of gallons per day would be preferred.

The present supply is confined to the city limits. These comprise an area of about 11,462 acres. The district actually supplied is 3,241 acres area. Of this, about 1,954 acres draws its supply from the distributing reservoir, while for the use of the remaining 1,287 acres the water requires to be pumped a second time. Immediately adjoining this high service district, on the west, lies a large tract of country at the same general elevation, extending to the base of the Watchung Mountain, which rises rapidly to an additional height of about 300 feet. This tract, which includes the various subdivisions of Orange, and also Bloomfield and Montclair, is so situated that any supply of water to the higher Newark level will naturally be used for it also, and any scheme looking to the full supply of Newark must necessarily include an amount of water sufficient for the use of a region so closely connected with the city proper by its position and topography.

In determining the boundaries of the water district we have, therefore, considered it advisable to include that part of Essex county which lies east of the crest of the Watchung Mountain, and which comprises (1) a strip along the Passaic river but slightly elevated above the river level, and adapted to business purposes; (2) a slope rising to an elevation of about 200 feet; (3) a plateau of a general elevation of about 200 feet, and already largely settled by a suburban population; and (4) the eastern slope of the Watchung Mountain, rising from 200 to 500 feet, and occupied by villa residences. To the north of the Essex county line it is probable that another system of supply will be adopted, when the necessity for it arises, and to the south, in Union county, the sudden breaking off of the foot hills leaves a wide expanse of flat country, which is now occupied by a number of growing towns, several of which have each their independent water works, and all of which are undoubtedly destined to be combined under one system at no distant day.

The water supply of Newark, under your board, comprises:

1st. Pumping works on the Passaic river near Belleville, consisting of two basins, each 140 by 340 feet, originally intended to act as filter and settling basins; an engine house, containing three steam pumping engines, of combined capacity of 18,000,000 gallons in 24 hours, with room for another engine; a force main of 30 inches diameter, leading to the Belleville Reservior, at an elevation of 167 feet above the river, and 6,000 feet distant from it.

2d. A distributing reservoir, 1,500 feet distant from the Belleville Reservoir, and at an elevation of 114 feet above the river.

3d. A High Service engine house, containing one pumping engine of a capacity of 3,000,000 gallons in 24 hours, with room for another engine.

4th. A High Service Reservoir, 9,000 feet distant, with its water surface at an elevation of 225 feet.

5th. About 130 miles of distribution pipe.

These works were constructed in 1869–70, the city having outgrown the capacity of a small system of supply from springs which had been in operation for several years, first under control of a private company, and since 1860 under the present organization. The cost of construction of these works has been, in round numbers, $3,500,000. Their present capacity is about 9,000,000 gallons per day. In 1878 the payment of interest on the debt amounted to $220,025. The cost of pumping to the Belleville Reservoir was $23,163.78; and for the high service reservoir, $8,105.11, making the total cost $251,293.57 for 2,657,400,900 gallons; or for every million gallons delivered, $94,56.

For comparison with the projects to be mentioned hereafter, the annual cost of delivering water to the distribution pipes is taken, omitting the cost of those parts of the existing works which must be common to any system:

Cost of Pumping works at river.....		$574,509 08
Cost of High Service pumping works....		61,710 49
		$636,219 57
Annual interest at 6 per cent.....	$38,173 17	
Expense of pumping	31,268 89	
	$69,442 06	

Or for every million gallons delivered, $26.13.

The above item of interest on the present plan will be common to all schemes which may be proposed. The estimates given further on do not include it, but are only for additional expenses which will be required.

To compare the cost of the various projects and their value to the city, the report makes a forecast of the growth of the population and increase of the consumption of water in other cities. The tendency is toward the proportion of one mile of pipe to every 1,000 inhabitants, and the probable population and water supply which will be needed for the next fifty years are as follows:

Year.	Population.	Miles of Pipe.	Daily Consumption.
1878.....	182,000	130	7,280,624
1880	196,000	145	8,700,000
1890.....	269,000	244	17,446,000
1900.....	353,000	353	34,897,500
1910.....	460,000	460	50,600,000
1920.....	628,000	628	69,080,000
1930.....	900,000	900	99,000,000

Any supply for Newark must be derived from the water-shed of the Passaic river. Within the area of 981 square miles drained by this stream above the present pumping works at Bellville, there are a number of locations from which it is practicable to conduct to Newark an ample supply.

The projects which have been examined are:

1. Those which contemplate the retention of the Belleville pumping station.

2. The removal of the works to Little Falls, and lifting the water there to an elevation sufficient to supply the water district.

3. The abandonment of pumping for the main supply and the introduction of water by gravity to a high level from the head waters of the Passaic. Pumping will, in any case, be needed for higher levels.

QUALITY OF WATER.

While chemically pure water is neither attainable no desirable, there are certain classes of impurities which, even in small quantities, are held to be sufficient to forbid the use of water for drinking. Chief among these is sewage pollution.

Authorities are extensively quoted in the report to show that water should not be contaminated by drainage, and that freedom from mineral salts and decomposing vegetable matter is also requisite.

The Passaic river valley is favorable to the collection of water in great purity. The water-shed above Paterson consists of a great central basin of 200 square miles area and an elevation of 120 to 180 feet above tide water. The branches of the main stream, which break through the Watchung Mountain above Paterson, are the Ramapo, the Ringwood, the Pequannock and Rockaway Rivers. The course and capacities of these are given in detail, as also those of the Passaic river and the sources of its pollution, stating also all the mills and the character of their discharges into the stream.

The results of chemical analyses of the waters are also given, showing a large excess of solid mat er and chlorine at the pump works, and quoting authorities to show that though impurities in water may escape chemical tests they may be unfit for drinking.

QUANTITY OF WATER.

The source of all water from any drainage area is the rainfall, and from twelve to fifteen inches in a year is as much as can be depended upon as the annual yield. Any source of supply must have such a drainage area that twelve or thirteen inches of rainfall upon it will give enough water for the yearly demand, and must also contain sites for storage reservoirs of one-fourth to one-third of this capacity. The rainfall upon the Passaic water-shed has been observed at three points, showing at Newark an average of 46.405 inches; at Lake Hopatcong 42.55 and at Paterson 53.85 inches.

In October last, when the water was as low in the Passaic as it has been known for thirty years, the flow at Paterson in forty-eight hours was 33,689,000 feet, or 126,334,000 gallons per day, and 0·23 cubic feet per second per square mile of drainage area.

In December a freshet occurred, in which the flow could not be measured at Paterson, but at Dundee it was at the rate of 17,913 cubic feet per second, or 11,579,072,838 gallons per day. These data show the greatest and least flow that may be expected.

The comparative economy of storage reservoirs and pumping by steam in dry months is discussed, and the conclusion is that it costs about $10 per year for every million of gallons stored, to make up deficiency in water power, while steam power to do the same work will cost from one to three-tenths of that amount.

EXAMINATION OF PROJECTS.

The retention of the present pump station at Belleville is deemed preferable on account of economy, but the water there is exposed to contamination from the back flow of Newark sewage, the drainage of Third River valley, the sewage of Passaic and Paterson, and the contamination from factories. The water is objectionable even now, and with increase of population must become more impure.

Several plans have been suggested to overcome the difficulty, which are considered in detail:

First—Filtration, which cannot be depended upon to purify *polluted* water. The great cost and uncertainty are serious objections.

Second—A dam across the river to cut off the pollution from the Newark sewage would be costly, involve damages during freshets, and require consent of the National Government.

Third—To take the water from above Dundee dam by pipe would cost $246,500, and the water would have to be paid for. It would also suffer from contamination at Paterson.

An intercepting sewer along the river bank from Paterson to Passaic would obviate this difficulty to some extent. The cost of works by this plan will be $670,000.

The last plan for the retention of the present works is to take the water above Passaic Falls. It is 116 feet above mean tide, and it seems absurd to bring it down ten miles to pump it up 167 feet again; but it is found cheaper to do this, and use the present works, than to build entirely new pump works in another situation.

The possibility of a supply from wells has recently been revived, and experiments have recently been made by the proprietors of the "drive well" patent. These are iron tubes, two inches in diameter, driven to a depth of forty feet, and the water is drawn by a

steam pump. They deliver about 650,000 gallons per twenty-four hours. The conclusion is that the water supply from this source is limited, and cannot be depended upon. An analysis of the water also showed that it is harder and contained more lime and chlorine than the river water.

This source of supply is especially objectionable, because the water is exposed to drainage from privies and cesspools. A district growing in population which is not supplied with sewers furnishes the most unwholesome water that can be used.

LITTLE FALLS.

At Little Falls, 4 miles above Paterson, and 10½ miles in a direct line from the office of the Aqueduct Board, which is taken as the centre of distribution, there is a fall of 32 feet in the Passaic river. The proposed reduction of Beatty's dam at this point, for drainage of the meadows above, will still leave an available head and fall of 22 feet for water power, and the drainage area of 832.75 square miles affords a certainty of water enough for supply and for pumping for many years. Two plans for utilizing this power have been considered. Both involve the purchase of the water rights of Mr. R. Beatty, the present owner, and their cost must be added to the estimates. There will also be damages to pay the owners of water power at Paterson, and possibly at Dundee, for the diversion of the water taken

From Little Falls the water can be pumped to a reservoir in the Great Notch, at an elevation of 310 feet above tide, and thence carried by pipe to a distributing reservoir at Montclair, 289 feet above tide, with a branch pipe to the Belleville Reservoir. As the water at the Falls is not sufficient in the dryest month to lift more than 8,000,000 gallons per day, supplementary steam power will be needed at once.

The elevation at which the water will be delivered in Montclair and in Orange will be sufficient to supply all the territory east of the Valley road in Orange, and no additional high service pumping will be needed.

The Belleville, Chatham street, and High Service reservoirs will all be needed for equalizing the pressure in the mains.

The works proposed at the outset consist of canal and flume of 50,000,000 gallons capacity, engine and pump-house at Little Falls. Three turbines of 240 horse power, capable each of pumping 7,500,000 gallons per day, and two steam engines, each 5,000,000 capacity, will be needed at first. Force main of wrought iron pipe, 40 inches in diameter, and 9,700 feet long, to reservoir in Great Notch. Wrought iron pipe, 48 inches in diameter, for 31,000 feet, to reservoir at Montclair, and 18,000 feet of branch pipe to Belleville reservoir.

The cost of these works will be $1,036,900, and their capacity 15,000,000 gallons daily. The cost of delivering water (interest at 6 per cent., $62,214, and expenses $18,625) will be $80,839, or $14.76 for each million of gallons. This is in addition to the cost of the present works and of the water rights.

With the same arrangement at Little Falls, but lighter machinery, the water may be lifted 80 feet, and carried through a tunnel 7,200 feet long to a reservoir in a natural ravine on the east side of the mountain, 220 feet above tide. From this point it would go through pipe to a reservoir at Orange, with an elevation of 196 feet, and also by branch pipe to Belleville reservoir. A high service engine and stand pipe will be needed at Orange. The less height to which the water must be pumped enables the least flow of the river to pump 15,000,000 gallons per day. Supplementary steam power will not be needed till 1885. The cost of the works would be $1,233,430, and their capacity 15,000,000 gallons daily. The cost of delivering that amount would be $101,232, or $18.49 for every million gallons.

It would be practicable to avoid the expense of purchasing the water rights at Little Falls by damming the river below that point, and pumping by steam to the reservoir in the Great Notch. The first cost would be about the same as the other plan, and the running expenses greater.

The Upper Passaic as a source of supply is considered, but deemed impracticable because of the flatness of surface and want of sites for storage reservoirs and the inferior character of the water.

ROCKAWAY RIVER.

The Rockaway river, at Boonton, has a drainage area of 126.65 square miles, capable of supplying 72,375,000 gallons per day from 12 inches of the rain fall. Storage will be needed at once, and the best site for a reservoir is in a ravine near Montville. When consumption has reached 20,000,000 gallons per day, more storage will be required, and reservoirs could be made of Splitrock Pond, five miles west of Boonton, another at Mount Pleasant, on Green Pond Brook, and there are other sites in the Rockaway Valley. The estimates from this source are based on a capacity of 50,000,000 gallons per day.

The distance from Boonton to the Belleville reservoir is 21·85 miles, and the difference of elevation 315 feet. A wrought iron pipe, passing by the sites of the Montville and Notch Reservoirs, would supply 11,000,000 gallons daily in the dryest seasons, at a cost of $636,760, or an annual cost of $9·51 per million gallons. The pipe already laid would be available till 1894, when it would have to be duplicated. Meanwhile the high service system could be supplied by a branch to Montclair, and no pumping needed, thus saving enormous expense.

To keep up with the progressive increase in consumption, additional supply can be procured from the Pequannock river, with storage reservoirs at Bloomingdale, Macopin pond, Dunker pond, and Stickle pond.

An estimate has been made of the cost of bringing water of the Rockaway and Pequannock rivers to the city by a masonry conduit, the whole supply to be delivered at Montclair Reservoir 289.2 feet above tide. The cost will be for 21.75 millions of gallons capacity $2,567,770: interest and maintenace, $165,086, or $20.80 for each million of gallons.

The annual cost of maintaining pipe lines is little more than that of supervising and taxes, and is estimated at $200 per mile. The cost of maintaining each storage reservoir is $1,500 per annum.

RINGWOOD AND RAMAPO.

Ringwood river, above Pompton, has an area of 118.42 square miles. After deducting the area required for Greenwood Lake and the Morris Canal it would supply 11,000,000 gallons per day, so that storage would be required at once. It would cost $1,150,000 to procure 25,000,000 gallons per day from this source at the Belleville Reservoir.

The Ramapo river has a drainage area of 168.5 square miles, furnishing 14.44 million gallons daily. It can be made to deliver 96,000,000 gallons, with storage reservoirs, but the Ringwood and Pequannock waters are superior to this.

THE MORRIS CANAL.

The use of the Morris Canal is considered at great length, and in all its aspects. The conclusions are that the water from Lake Hopatcong cannot be brought to Newark by using the canal as a channel, on account of losses by leakage, evaporation, etc.

The total cost of works capable of delivering 50,000,000 gallons per day at Bloomfield would be $4,060,000 excluding storage there and its connection with the Belleville Reservoir.

The use of an open canal is pronounced the most objectionable of any method that can be devised on account of its exposure, expense of supervision and repair, liability to obstruction by ice in Winter, and certainty of being unwholesomely heated in Summer.

The report is accompanied by a series of elaborate tables, showing the details of cost of the seven projects, which seem most worthy of attention, and the annual cost of operating the works, which latter is the true criterion for judging their relative value.

The expenses of delivering water by the several schemes in five years after construction rank as follows, the least expensive being placed first:

1. Rockaway, gravity supply by pipe.
2. Little Falls, pumping supply to high reservoir.
3. Belleville, pumping supply from Paterson.
4. Little Falls, pumping supply to low reservoir.
5. Belleville, pumping supply from Dundee.
6. Rockaway, gravity supply by conduit.
7. Ringwood, gravity supply by conduit.

In 25 years the order will be changed, and the Little Falls' plans will be cheapest, Rockaway next, then Ringwood and Belleville pump works last and costliest.

Acknowledgement is made of assistance rendered and information given by the Superintendent of the Water Board, Mr. Ward and others. The surveys were conducted by Mr. W. A. Thompson, assisted by Mr. F. H. Williams, who also assisted in the calculations and compilations of statistics, and maps were prepared by Mr. T. H. Loomis, and diagrams by Mr. J. A. Briggs.

The report is signed by the engineers, Messrs. J. J. R. Croes and George W. Howell.

A New Method of Determining High Temperatures.

In very many manufactures an enormous degree of heat is required for carrying out the various operations. The means hitherto at our disposal for testing those temperatures, which sometimes require to be accurately regulated, are limited by the point of fusion of the thermometric tube.

Mr. Crova, Professor at the Faculty of Sciences at Montpellier, has had the ingenius idea of bringing the spectroscope to the aid of the manufacturer, and his efforts have been most successful. By the means he has adopted, heats hitherto incalculable can be determined very precisely. The process by which he proceeds is, roughly speaking, to adopt a fixed standard, and, having settled that point, to examine by the aid of a spectroscope, the flames of the incandescent objects, and reduce them by interposing obstructives of known power to the same level as the standard. That arrangement he calls a spectro photometor. Of course, in such an apparatus, the primary data must be purely arbitrary. M. Crova takes as the point of departure the heat emitted by an ordinary moderator lamp burning oil, and that he fixes at 1,000. In comparing other incandescent substances with that standard, he finds that the heat of a piece of platinum, warmed to the red in a gaslight, is 524; the same material raised to a white heat by the blow-pipe, 810; a regulation stearine candle, 1,162; an Argand burner of ordinary gas, 1373; the oxy-hodrogen light (common gas and oxygen on lime), 1,806; the electric light (sixty Bunsen elements), 3,060; and the light of the sun, 4,049. Carbon, lime, and platinum, when incandescent, have the same power, and probably magnesium.

This new system is calculated to be of vast importrnce to manufacture, by enablidg the operator to regulate his fire so as to produce the precise effect desired. M. Dumas, in bringing the matter under the notice of the Academy of Sciences, stated that he considered it as the greatest discovery of modern times, and M. Berthelot warmly supported his statement.—*Galignani.*

Parriffine as a Lubricant.—By the use of paraffine the Erie Railway has considerably reduced its oiling expenses on passenger-car journals, and has redeced the number of hot journals from 535 to 382. It is now used during the winter months without the addition of any other oil, but it is found that in summer it becomes so limpid that it is hard to keep it in the Axle boxes. During the summer months it is, therefore, mixed with some other lubricant to give it more "body."—*Iron Age.*

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WEDNESDAY, APRIL 2, 1879.

Official Report of Examinations of Gas for three Weeks ending Mar. 29, 1879, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Mar 1879.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
10	Between 9.30 A.M. and 1 P. M.	15.20	16.88	18.27	16.38	16.64	
11		15.28	16.64	17.39	16.47	16.52	
12		15.12	16.78	17.75	16.68	16.62	
13		15.20	16.96	16.89	16.60	16.49	
14		15.72	17.41	17.73	16.73	16.50	
15		16.54	17.42	18.53	16.64	16.43	
	Average	15.51	17.01	17.76	16.58	16.53	
17		16.39	15.88	19.12	16.82	16.34	
18		16.23	16.38	18.45	17.01	16.61	
19		16.31	16.48	18.32	17.15	16.53	
20		16.28	17.04	18.98	17.54	16.62	
21		16.67	16.43	18.71	17.07	16.52	
22		16.28	16.40	19.06	17.01	16.40	
	Average	16.36	16.43	18.77	17.10	16.50	
24		16.51	16.70	19.08	16.78	16.68	
25		16.92	17.26	19.14	16.60	16.40	
26		16.62	17.16	19.22	16.65	16.52	
27		16.78	16.74	19.02	16.64	16.54	
28		16.81	16.90	19.34	16.85	16.60	
29		16.92	17.26	18.65	17.17	16.80	
	Average	16.76	17.00	19.07	16.78	16.59	

Sugg-Letheby burner.

E. G. LOVE, Gas Examiner.

Circumstances Influencing the Efficiency of Dynamo-Electric Machines.

BY PROFS. EDWIN J. HOUSTON and ELIHU THOMSON.

Read before the American Philcsophical Society, Nov. 1, 1878.

During the recent competitive trials made at the Franklin Institute as to the relative efficiency of some different forms of dynamo-electric machines, the authors having been entrusted with the work of determining the relations between the mechanical power consumed and the electric and thermic effects produced, took the opportunity thus afforded to make a careful study of many interesting circumstances which influence the efficiency of these machines.

It is purposed in the present paper to select from the many circumstances thus noticed a few of the more interesting, reserving the others for future consideration.

It will be readily understood that from the comparatively new field in which we have been working no reliable data of the electrical work of these machines having before been obtained, difficulties constantly arose owing to necessary conditions of operation, and new developments as to the behavior of the machines under varied conditions, were constantly met.

A convenient arrangement of the particular circstances we are abont to discusss may be, 1st, Those affecting the internal work of the machine; 2d, Those effecting the external work; and 3d, The relations between the internal and external work.

The mechanical energy employed to give motion to a dynamo-electric machine is expended in two ways, viz., 1st, In overcoming friction and the resistance of the air; and 2d, In moving the armature of the machine through the magnetic field, the latter, of course, constitnting solely the energy available for producing electrical current. The greatest amount of power expended in the first way was noticed to be about 17 per cent. of the total power employed. This expenditure was clearly traceable to the high speed required by the machine. The speed therefore required to properly operate a machine is an important factor in ascertaining its effciency.

The above percentage of loss may not appear great, but when it is compared with the total work done in the arc, as heat, constitnting as it did in this particular instance over 50 per cent. of the latter, and abont 33 per cent. of the total work of the circuit, its influence is not to be disregarded. In another instance the work consumed as friction was equal to about 80 per cent. of that appearing in the arc as heat, while in the Gramme machine experimented with this percentage fell to 20 per cent. of that which appeared in the arc as heat, and was only about 7 per cent. of the total power consumed in driving the machine.

In regard to the second way in which mechanical energy is consumed, viz., in overcoming the resistance necessary to move the armature through the magnetic field, or, in other words, to produce electrical current, it must not be supposed that all this electrical work appears in the circuit of the machine, since a considerable portion is expended in producing what we term the local action of the machine—that is, local circuits in the conducting masses of metal, other than the wire, composing the machine.

The following instances of the relation between the actual work of the circuit and that expended in local action, will show that this latter is in nowise to be neglected. In one instance an amount of power somewhat more than double the total work of the circuit was thus expended. In this instance also it constituted more than five times the total amount of power utilized in the arc for the production of light. In another instance it constituted less than one-third the total work of the circuit, and somewhat more than one half the work in the arc.

Of course work expended in local action is simply thrown away, since it adds only to the heating of the machine. And since the latter increases its electrical resistance, it is doubly injurious.

The local action of dynamo-electric machine is analogous to the local action of a battery, and is equally injurious in its effects upon the available current. Again, in regard to the internal work of a machine, since all this is eventually reduced to heat in the machine, the temperature during running must continually rise until the loss by radiation and convection into the surrounding air equal the production, and thus the machine will acquire a constant temperature. This temperature, however, will differ in different machines, according to their construction and the power expended in producing the internal work, being, of course, higher when the power expended in producing the internal work is proportionally high.

If, therefore, a machine during running acquires a high temperature when a proper external resistance is employed, its efficiency will be low. But it should not be supposed that because a machine when run without external resistance, that is on short circuit, heats rapidly, that inefficiency is shown thereby. On the contrary, should a machine remain comparatively cool when a proper external resistance is employed, and heat greatly, when put on short circuit, these conditions should be regarded as a proof of its efficiency.

As a rule the internal resistance of dynamo-electric machines is so low that to replace them by a battery, the latter, to possess an equal internal resistance, would have to be made of very large dimensions, so that the efficiency of dynamo-electric machines cannot be stated in terms of battery cells as ordinarily constructed.

In regard to the second division, viz., the external work of the machine, this may be applied in the production of light, heat, electrolysis, magnetism, etc.

Where it is desired to produce light, the external resistance is generally that of an arc formed between two carbon electrodes; the resistance of the arc is therefore an important factor in determining the efficiency. To realize the greatest economy, the resistance of the arc should be low, but nevertheless should constitute the greater part of the entire circuit resistance.

In some of our measurements the resistance of the arc was surprisingly low, being in one instance .54 ohm., and in another .79 ohm. It was, however, in some instances as high as 3·18 ohms.

It may be noted, as an interesting fact, that where the greatest current was flowing, the resistance of the arc thereby produced was low. This is undoubtedly due to higher temperature and increased vaporization from the carbons. In this latter case also the greatest amount of light was produced.

The amount of work appearing in the arc as measured by the number of foot pounds equivalent thereto, is not necessarily an index of the lighting power. In two instances of measurement, the amount of energy thus appearing in the arc was equal, while the lighting powers were proportionately as three to four. This apparent anomaly is explained by considering the resistance of the arc, it being much less in the case in which the greater light was produced. The heat in this case being evolved in less space, the temperature of the carbons, and therefore their light giving powers, was considerably increased

A few remarks on the economical production of light from electrical current may not be out of place. The light emitted by an incandescent solid will increase as its temperature is increased. In the voltaic arc the limit to increase of temperature is in the too rapid vaporization of the carbon. Before this point is reached, however, the temperature is such that the light emitted is exceedingly intense. No reliable method of measuring the temperature of the arc has as yet been found.

A well known method of obtaining light from electrical currents is by constructing a resistance of some material such as platinum having a high fusing point and heated to incandescence by the passage of a current. When platinum is employed the limit to its increase of temperature is the fusing point of the platinum, which is unquestionably but a fraction of the

temperature required to vaporize carbon. Were the falling-off in the amount of light emitted merely proportional to the decrease in temperature, the method last described might be economical. Unfortunately, however, for this method, many facts show that the decrease in the light emitted is far greater than the decrease of the temperature. Most solids may be heated to 1000°F., without practically emitting light. At 2000°F., the light emitted is such that the body is said to be a bright red. At 4000°F., the amount of light will have increased more than twice, probably as much as four times that emitted at 2000°F. It is reasonable to suppose that with a further increase of temperature, the same ratio of increase will be observed, the proportionate increase in luminous intensity far exceeding the increase in temperature.

It would therefore appear that the employment of a resistance of platinum or other similar substance, whose temperature of alteration of state as compared with that of carbon is low, must be far less economical than the employment of the arc itself, which as now produced has been estimated at about two or three times less expensive than gas.

Indeed it would seem that future improvements in obtaining light from electrical currents will rather be by the use of a sufficient resistance in the most limited space practicable, thereby obtaining in such space the highest possible temperature.

Perhaps the highest estimate that can be given of the efficiency of dynamo-electric machines as ordinarily used, is not over 50 per cent., our measurement have not given more than 68 per cent. Future improvements may increase this proportion. Since the efficiency of an ordinary steam engine and boiler in utilizing the heat of the fuel is probably overestimated at 20 per cent., the apparent maximum percentage of heat could be recovered from the current developed in a dynamo-olectric machine would be overestimated at 10 per cent. The economical heating of buildings by means of electricity may therefore be regarded as totally impracticable.

Attention has, long ago, been directed to the use of dynamo-electric machines for the conveyance of power. Their employment for this purpose would indeed seem to be quite promising. Since in this case one machine is employed to produce electrical currents, to be reconverted into mechanical force by another machine, the question of economy rests in the perfection of the machines and in their relative resistances.

In respect to the relations that should exist between the external and internal work of dynamo-electric machines, it will be found that the greatest efficiency will, of course, exist where the external work is much greater than the internal work, and this will be proportionately greater as the external resistance is greater. Our measurements gave in one instance the relation of .82 ohm. of the arc to .49 ohm. of the machine, a condition which indicates economy in working. The other extreme was found in an instance where the resistance of the arc was 1.93 ohm., while that of the machine was 4.60 ohms., a condition indicating wastefulness of power.—*Jour. Franklin Inst.*

Electric Light Failure.—The electric light now being tried in the Conant Thread Mills, under the superintendence of the Brush Electric Light Co., has thus far proved a failure. Unless the lamps are placed in just such a position in respect to the machines, they are thrown in such a deep shadow that they can hardly be seen. At a public trial, after the lamps had been so placed as to be satisfactory, they failed to wholly illuminate the room. It seems that the circuit was broken by the wire coming in contact with a bolt extending through the floor from the room above, thus disseminating the electric fluid. Another objection to the apparatus is that it consumes too much power. However, the manufacturers of the lamps say they can, by experimenting, remove all obstacles.—*Providence Journal.*

New Plan for Filling Gas Meters.—The chemical laboratories of Jacobsohn and Brunje, at Leopold's Hall, near Strassfurt, Germany, have introduced a new fluid for filling wet gas meters, composed mainly of a solution of chloride of magnesium. The meter of the Royal Polytechnic Institute, at Hanover, was filled, Dec. 8th, 1877, with 142 litres of the same, of a sp. gr. of 1·201. By the 15th the contents had increased by 1·5 litres and the sp. gr. was 1·190. Examination at different times showed that:

On Dec. 21, 1877, the sp. gr. was					1·181
" Jan. 20, 1878,	"	"	"	"	1·182
" Mar. 3,	"	"	"	"	1·179
" June 1,	"	"	"	"	1·178
" July 15,	"	"	"	"	1·174

On July 15th, 1878, the meter was opened, and the solution analyzed. No trace of a foreign material (iron or tin) was found, but it contained in 100 cubic centimeters 0·0214 grammes of NH_3 (ammonia) abstracted from the passing gas. A portion of the solution was cooled to 10° without freezing. During the whole time no replenishing had been necessary. *Journal fur Gasbeleuchtung.*

Petroleum in Japan—Petroleum refining is making rapid headway in Japan. Petroledm is met with in the provinces of Echigo-Shinano, Uyo, and Totomi. The number of wells sunk to obtain the oil exceeds 600. The yield of these is about 3,420 litres of two kinds of oil. The one, clear, contains 8 per cent. of light oil, 33 per cent of burning oil, 48 per cent. of heavy oil, and 12 per cent. of residue. The other, which is dark, only contains 9 per cent. of lamp oil, 58½ of heavy oil, and 32½ of residue. At Shinano the daily flow or yield from 39 wells is about 1,600 litres, the greater part of which is dark colored, and only contains about 13 per cent. of burning oil. —*Ironmonger.*

Excavations and Foundations in Sand.—M. Plocq has published an interesting note upon the recent harbor improvements at Dunkerque and Gravelines. There are ten sluices for controlling the fresh and salt waters of the districts, for various purposes of maritime and domestic economy, as well as for the wants of the military service and for defensive operations in time of war. The sluices are built in a soil which is wholly made up of pure sand, of flour-like fineness, reaching to a depth of 15 or 20 metres (16·4 to 21·9 yards) below the lowest tidal levels. The works were all executed by the help of cofferdams, in preference to dredging, and the preparations were so thorough that it was always easy to work in dry sand even at the lowest foundation levels. The total cost was less than half what it would have been by the whole method of dredging, and the saving of time was in about the same ratio.—*Ann. des Ponts et Chaussees.*

Liquid Rings.—M. Escriche.—If from a small height we let fall slowly into a dilute solution a few drops of another solution capable of forming a precipitate with the former, we see rings formed which descend to the bottom of the vessel, rolling over upon themselves just as do the rings produced by the liberation of phosphorus trihydride.—*Les Mondes.*

Prices of Gas Coal.

Penn and Westmoreland		$4.50 at New York.
"	"	3.50 at Baltimore.
"	"	3.75 at Philadelphia.
Despard, Newburgh Orrel, Murphy Run		4.25 at New York. 3.50 at Baltimore.
Chesapeake & Ohio		4.50 at New York.
"	"	
Newcastle		3.25 to 3.50
Provincial		3.50 to 3.75
Cannelton Cannel		8.50 at New York.
Ince Hall		7.25

The above prices are about $1 per ton below those of 1878.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)

24 Pine Street, New York City.

April 2, 1879.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked.
Gas Co.'s of N. Y. City.				
Central	466,000	50	60	75
Harlem	1,800,000	50	40	50
" Bonds	170,000			103
Manhattan	4,000,000	50	180	190
Metropolitan	2,500,000	100	115	122
" Scrip	$1,000,000	..	99	103
Mutual	5,000,000	100	70	75
" Bonds, gold	900,000	1000	95	99
Municipal	1,500,000	100	110	117
" Bonds	750,000		95	100
New York	4,000,000	100	98	103
Nothern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	140	145
Citizens	1,200,000	20	67	75
" Scrip	320,000	1000	90	95
Peoples	1,000,000	10	20	30
" Bonds	325,000	...	—	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	60	65
Nassau	1,000,000	25	70	75
" Ctfs.	700,000	1000	90	95
Williamsburgh	1,000,000	50	85	90
" Scrip		...	90	95
Kings Co	200,000	100	—	70
Union Co. E N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	60	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	95	98
" Ctfs., gold	1,000,000		95	10
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	90	95
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			128	13
Cincinnati G.& C.Co.				190
Derby of Conn	160,000	100	60	80
East Boston, Mass		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	120	125
Hempstead, L. I	25,000	100	...	—
Jersey City	386,000	20	140	145
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Lima, Ohio,	60,000	100	—	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	—	75
Long Branch		20	30	40
New Haven, Conn		25	136	152
Peoples, Jersey City		...	—	80
" " Bds.				95
Peoples of Albany	650,000	100	10	17
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	44	48
" Bonds			106	—
Plainfield, N. J	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Toledo, Ohio			95	97
Washington, D. C		20	—	200
Yonkers		50	70	80

Woonsocket, R. I....	150,000	100	80	...
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150,000	40	117½	
Pittsfield, Mass.....			120	130
Rondout & Kingston			75	80
St. Louis, Missouri..	600,000	50	73	75
Stillwater, Minn.....	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens..	600,000	100	—	60
San Francisco Gas Co., S. Fr'isco Cal.			95	95¼

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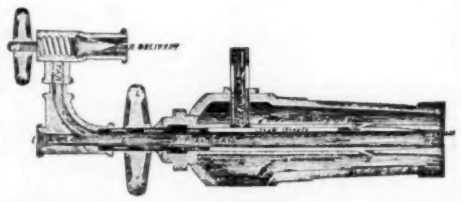

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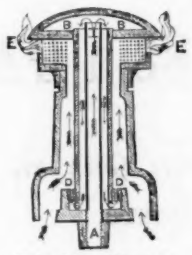

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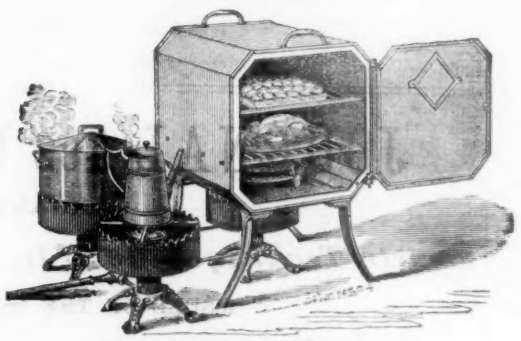
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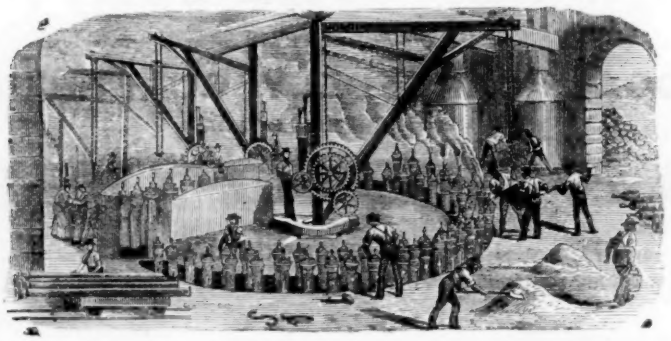

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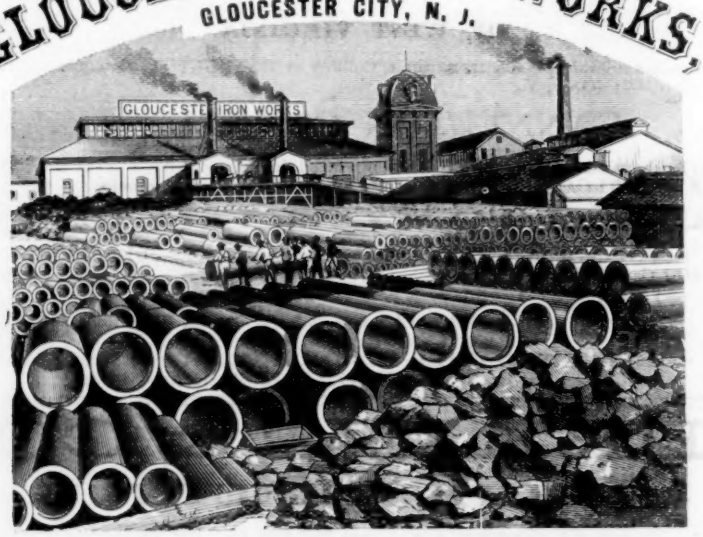

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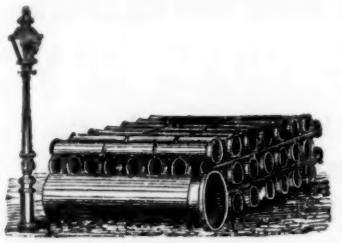

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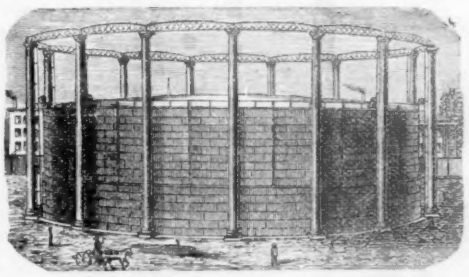

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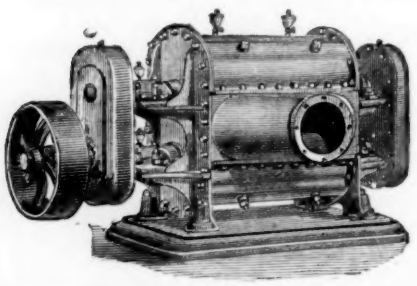

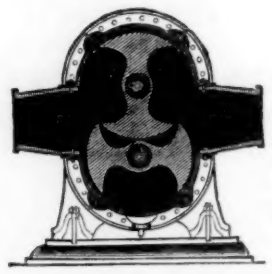

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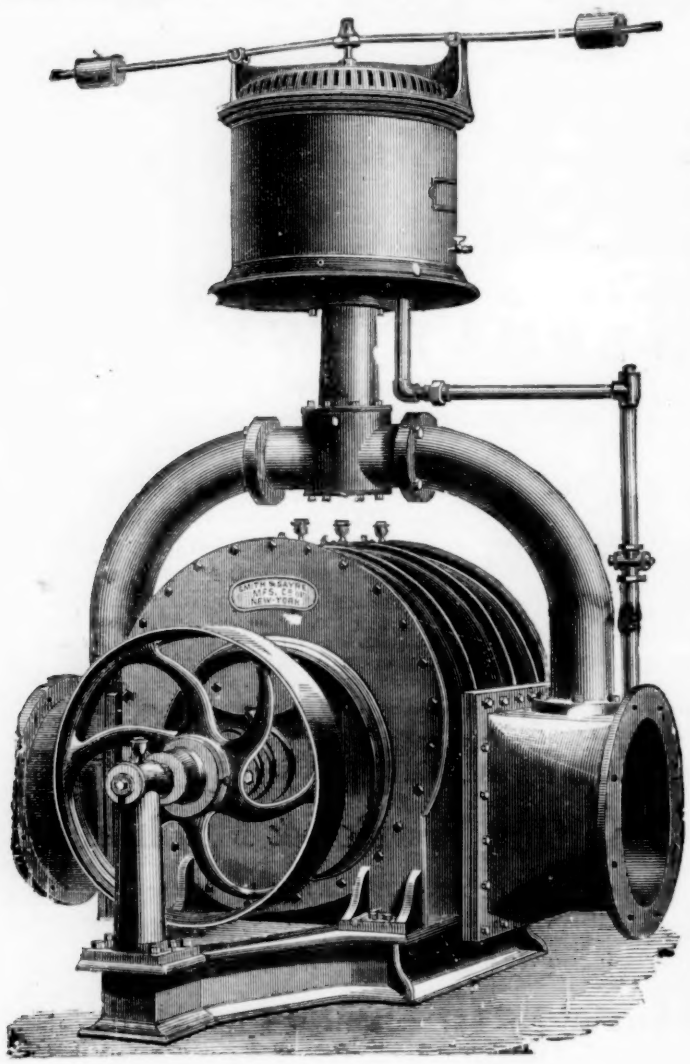

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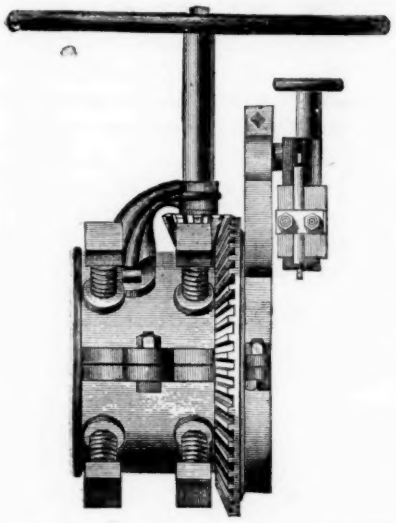

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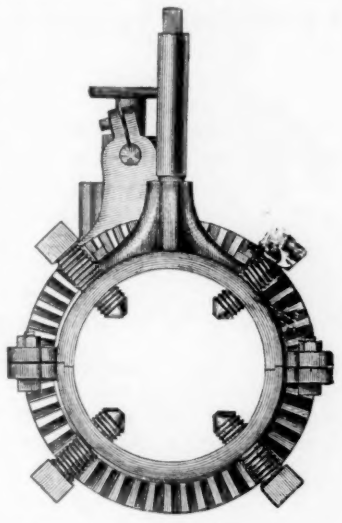

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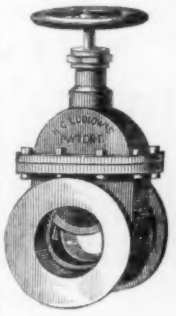

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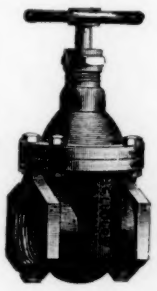

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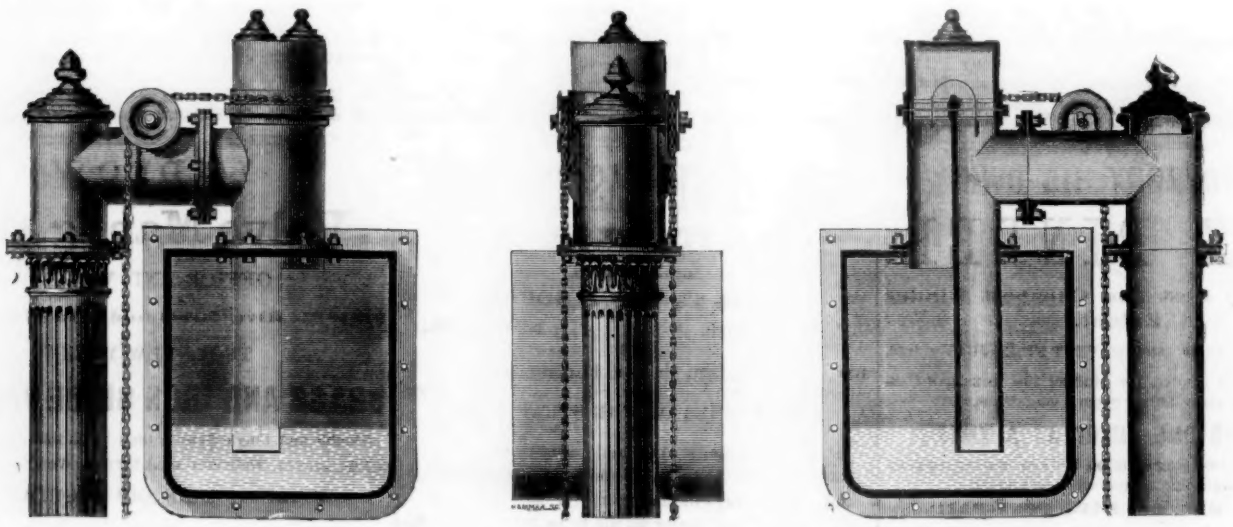

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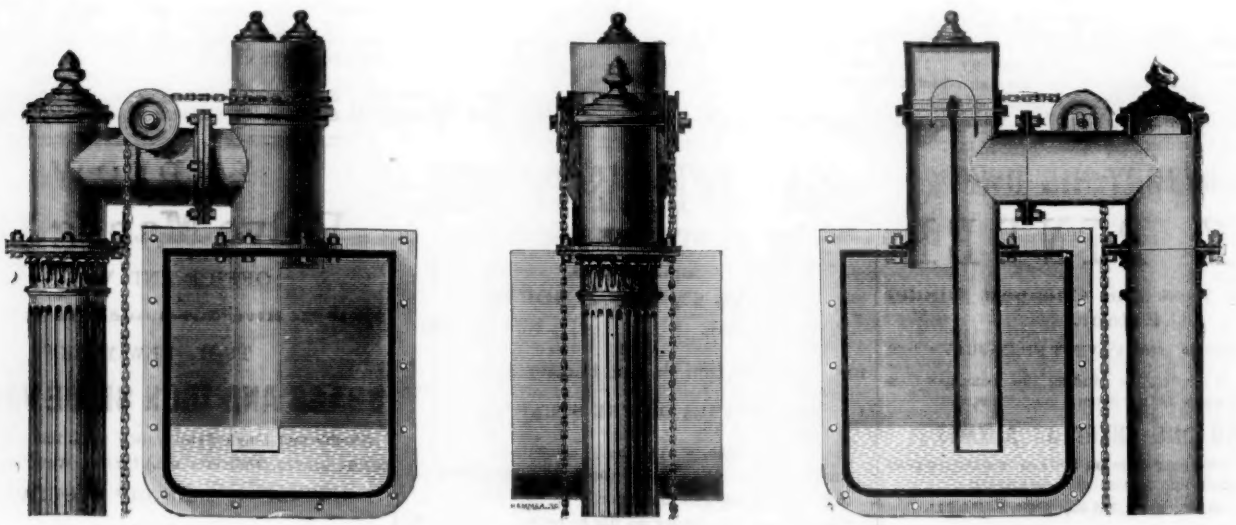

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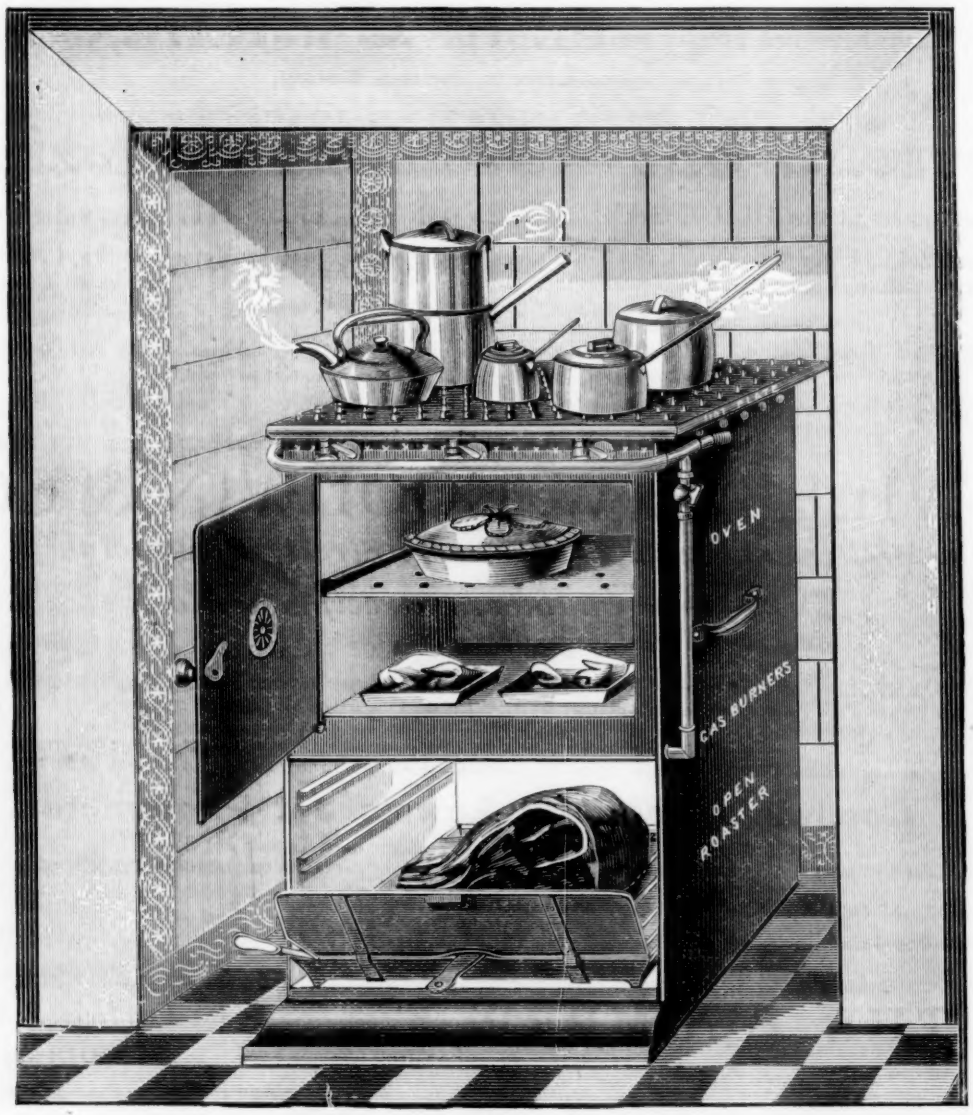

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